GY DEPT

AUGUST 1945

POWER

GENERATION, TRANSMISSION AND APPLICATION OF ALL THE POWER SERVICES

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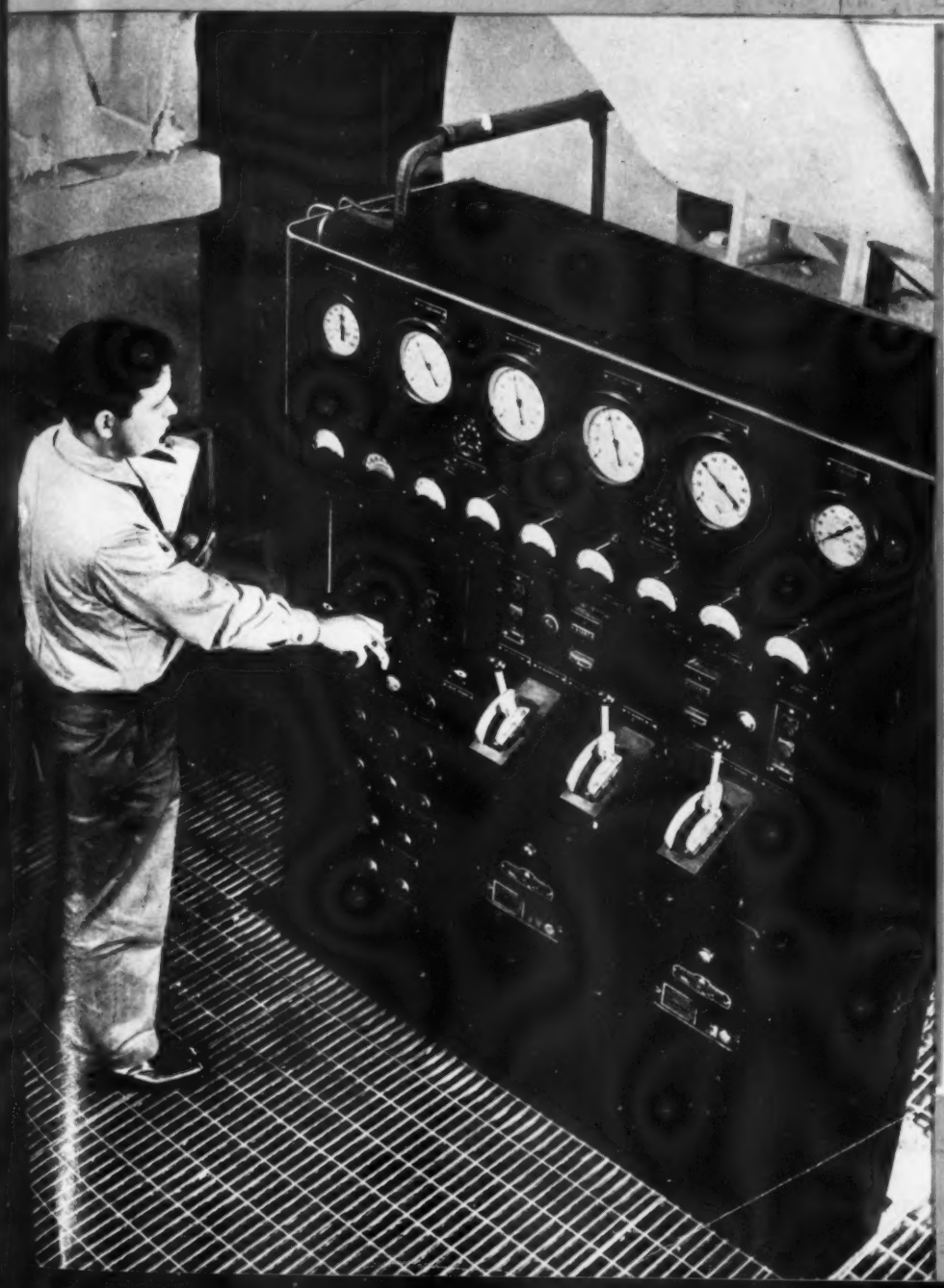

One-man control marks new 2500-hp gas-turbine marine unit with rotary compressor

Gas turbines: Progress report on recent developments outlines a research program aimed at developing a coal-burning locomotive unit, describes design of first successful American-built power unit with rotary compressor, summarizes test results on 2500-kw closed-cycle machine and gives comprehensive data on operation and maintenance of commercial units in oil-refinery service. Starts p 73

Canada's largest steam plant, built in one year under rigid war restrictions, boasts 1,500,000 lb per hr of steam capacity and 27,000 kva in generators. Two separately fired superheaters supply 1400-F process steam. For complete design details turn to descriptive article on p 64

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Page 59

PIONEERING *in the early* 20's

Do you remember the early 1920's, when many of us sat up half the night with our ears pinned down and numbed by a radio headset, while we tickled the cats-whisker of our crystal radio set hoping to get some distant (or even nearby) station. Radio has made great progress since those early pioneering days . . . and this progress has been paralleled by improvement in ash and dust handling methods, pioneered-developed-patented-installed and operated by our company over this same span of years.

Back in the early 20's, our company was confident that dirt, dust, fumes, falling water, and fog could be eliminated from the unhealthy ash tunnel. Time has proved we were right. The ash tunnel has long been an ash basement, as clean and dry as the turbine room.

First came the perfection of a Water Collecting Ash Gate, known as the "Type C", closely followed by the A-S-H Sectional Cast Iron Plate Ash Hopper. Locktile, a refractory shape, gravity locked in place for lining these hoppers, followed, together with A-S-H quenching units used to distribute a uniform spray over the entire ash accumulation.

Next came the Cast Iron, Sectional Plate, Catenary Coal Bunker, which "breathes" under load.

Then, with the trend toward larger units differently fired, came the development of the Hydrojet System, an air-tight, water-tight, dust-tight system which quickly, automatically and economically removes large ash tonnages rapidly and with no manual effort.

Next came the Hydravac System for removing dust from various pockets throughout the plant, with the Hydravactor unit, windsweeping principles, etc.

The Hydroseal Pump with the principle that revolutionized the design of materials handling pumps; Dehydrating sumps and tanks with anti-freeze water collecting gates embodying dehydrating principles; continuous dust unloaders and the Mylting Mixer all followed in order.

These are the major products pioneered, developed and "made to work" by our engineers. Their perfection did not come easy. There were many disappointments and heartaches. The development of each product required many new inventions to contribute to its ultimate success. But that is another story. We believe you'll be interested, so we're going to follow this advertisement with others, which will outline the step-by-step development of each.

And now for the $25.00. Simply because we have no illustration to show our early hoppers and gates, we're asking you to look in your files for a catalog referring to these products as being "Built Like a Battleship." We'll pay $25.00 for the first ten of these catalogs sent to this office and we'll acknowledge receipt of those from whom they were received in a later advertisement.

$25 for an OLD CATALOG

AS ALWAYS (A-S-H) WILL PIONEER IN ASH AND DUST REMOVAL

ALLEN-SHERMAN-HOFF CO., 227 S. 15th St., PHILADELPHIA 2, PA. *Offices & Representatives in Principal Cities*

POWER (with which are consolidated "Science and Industry," "The Engineer Review," "The Engineer," and "The Stationary Engineer"), August, 1945, Vol. 89, No. 8. Published monthly with an additional Directory number in December. McGraw-Hill Publishing Company, Inc. Publication office, 99-129 North Broadway, Albany 1, N. Y. Editorial and Executive Offices, 330 West 42nd Street, New York 18, N. Y. Entered as second class matter, August 25, 1936, at Albany, N. Y., under the act of March 3, 1879. Printed in U. S. A. Allow at least ten days for change of address. All communications about subscriptions should be addressed to the Director of Circulation, Power, 330 West 42nd Street, New York 18, N. Y. Subscription rates—U. S. and U. S. Possessions, $3.00 for one year, $4.00 for two years. Canada, $3.50 for one year, $5.00 for two years. Great Britain and British Possessions, 36 shillings per year. All other countries, $6.00 for one year, $9.00 for two years. Single copies 35 cents.

TECHNOLOGY DEPT:

Economical Coal Handling —By Screw Conveyor— at ECONOMY FUSE →

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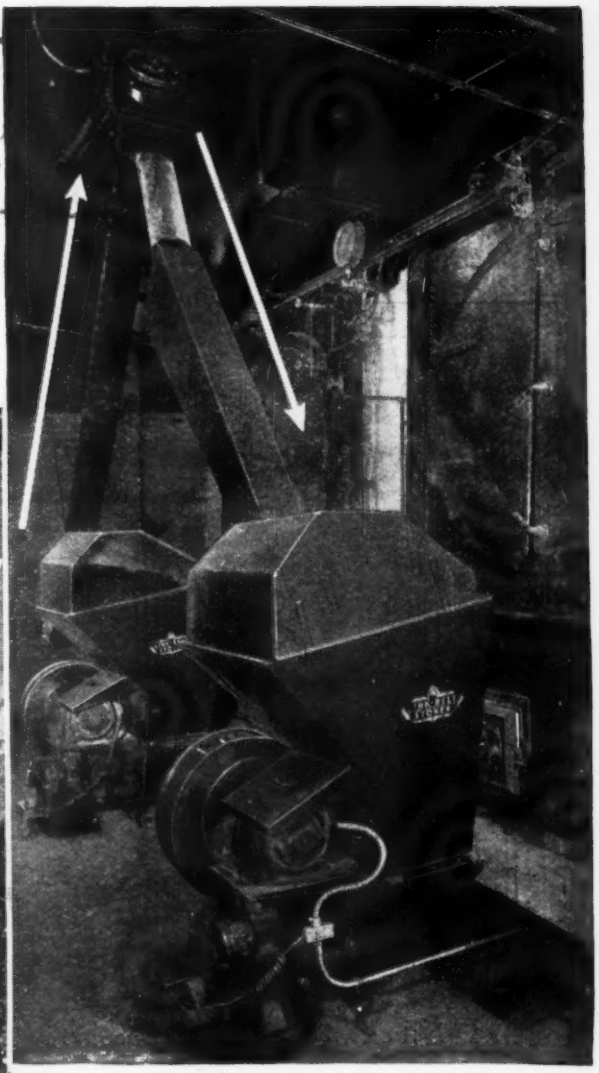


The two photographs show different views of the screw conveyor, swinging spout and stoker installation at Economy Fuse & Manufacturing Company.

● An ingenious, low-cost method of handling coal to the hoppers of two Link-Belt stokers from floor-level storage, at the Chicago plant of Economy Fuse & Manufacturing Company, utilizes an inclined Link-Belt screw conveyor with hinged discharge spout that permits coal delivery to either hopper as desired.

Differing from the usual design of screw conveyor, this unit has the worm operating in a round duct, split for accessibility. The 500 lb. per hour feed capacity Link-Belt stokers are automatically controlled by pressurestats. Hinged stoker hoppers permit access to boiler for cleaning.

This semi-automatic combination of screw conveyor and stokers is paying big dividends in cutting coal handling costs . . . solving a labor problem... and cutting steam costs through higher boiler efficiency and the use of lower cost coal.

LINK-BELT COMPANY

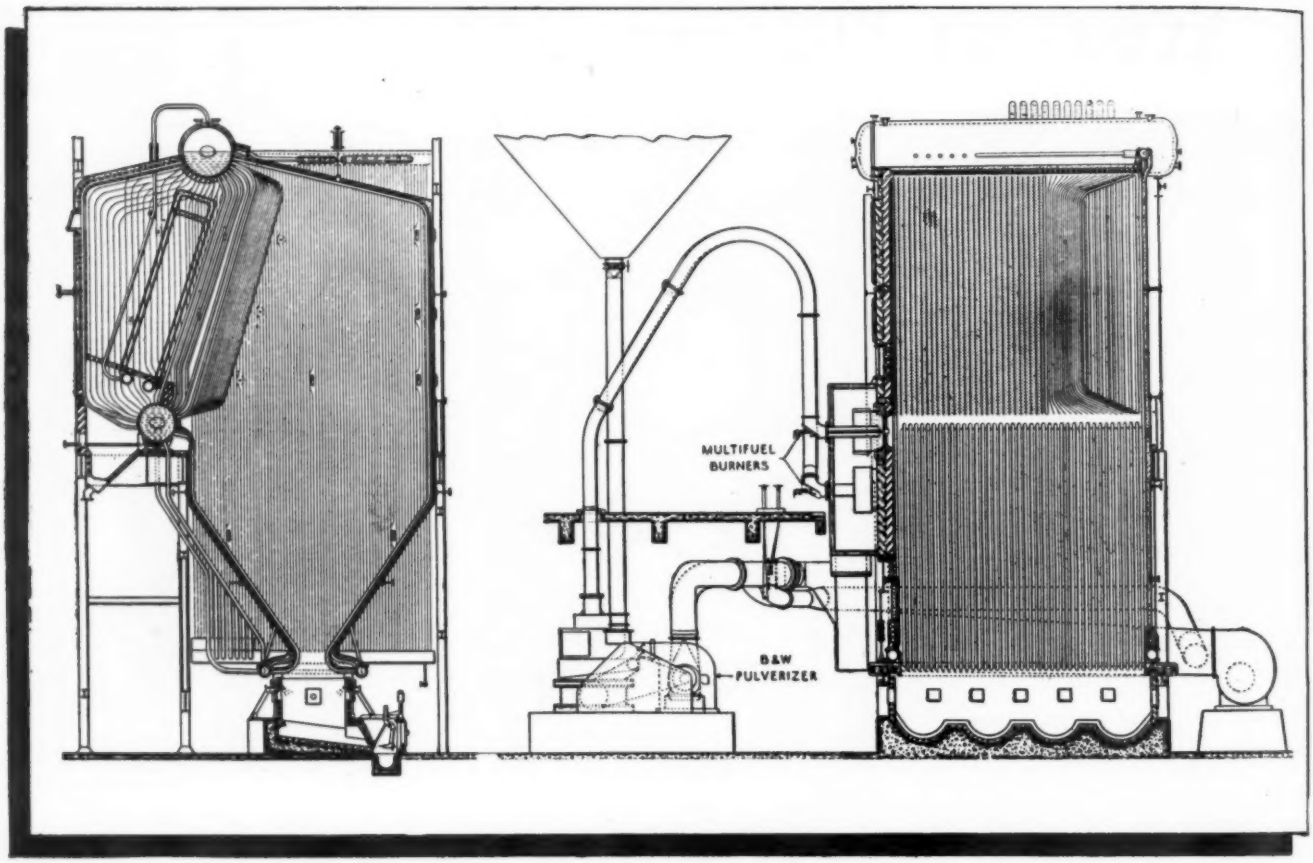
Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Dallas 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8.
Offices in Principal Cities.

8960

LINK-BELT

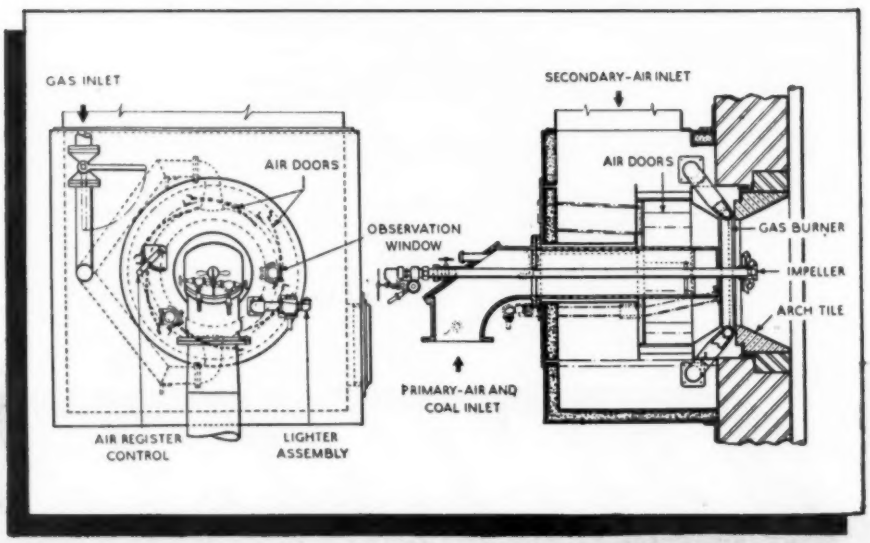
Coal and Ashes Handling Equipment

Use All Three



Above—Typical B&W Integral-Furnace Boiler arranged for Multi-Fuel Firing.

Right—Details of B&W Multi-Fuel Burner.



with ONE Burner

Whether there is a COAL shortage or an OIL shortage there's no need for converting and then re-converting . . . or installing *separate* burners for coal, oil, and gaseous fuels when any fuel becomes scarce. Variations in fuel availability can always be met when your boilers are equipped with the

B&W MULTI-FUEL CIRCULAR BURNER
for Pulverized Coal, Oil, and Gas

This burner provides in ONE compact unit the features of the B&W Combination Oil and Gas Burner and those of the B&W Circular Burner that is so widely used for pulverized fuels. This combination, properly co-ordinated with furnace and boiler design, provides a wide latitude in choice of fuels:—all grades of coal and petroleum coke in pulverized form, oil, and gas. These may be burned singly or in any desired combination. High combustion efficiency with *any* fuel is assured through turbulent mixing of fuel and air. Let Babcock & Wilcox engineers explain how this equipment can simplify your fuel-burning problems.

Send for Bulletin G-20 A describing this B&W Multi-Fuel Burner and the B&W Combination Oil & Gas Burner.

B&W

Water-Tube Boilers, for Stationary Power Plants, for Marine Service . . . Water-Cooled Furnaces . . . Superheaters . . . Economizers . . . Air Heaters . . . Pulverized-Coal Equipment . . . Chain-Grate Stokers . . . Oil, Gas and Multifuel Burners . . . Seamless and Welded Tubes and Pipe . . . Refractories . . . Process Equipment.

BABCOCK & WILCOX

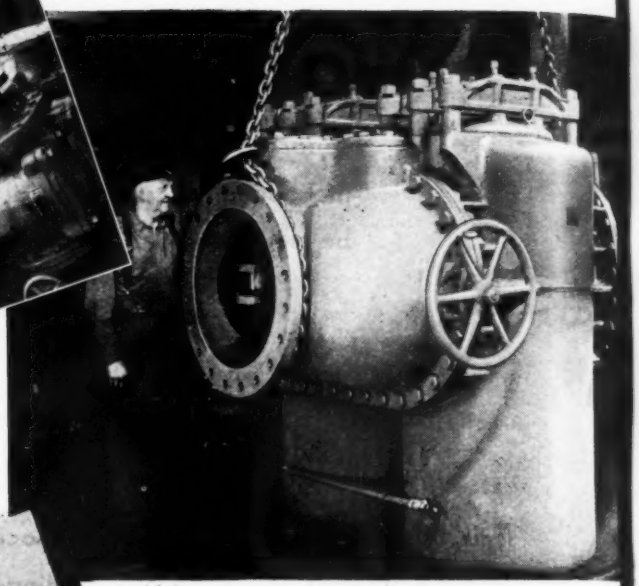
THE BABCOCK & WILCOX CO.
85 LIBERTY STREET · NEW YORK 6, N. Y.

G 289T

Front-line

Typical Elliott strainer installation on shipboard. Thousands of these are proving their indispensable qualities in warships of all types and Maritime Commission vessels.

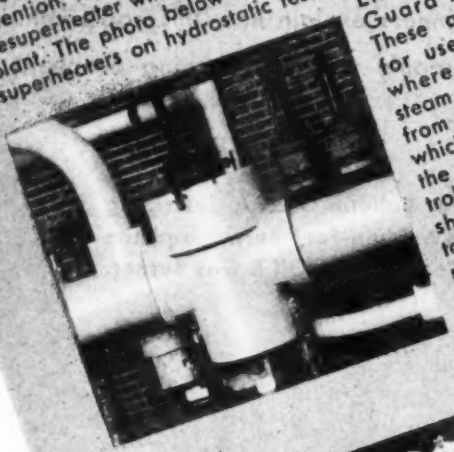
A group of marine type strainers being checked for shipment.

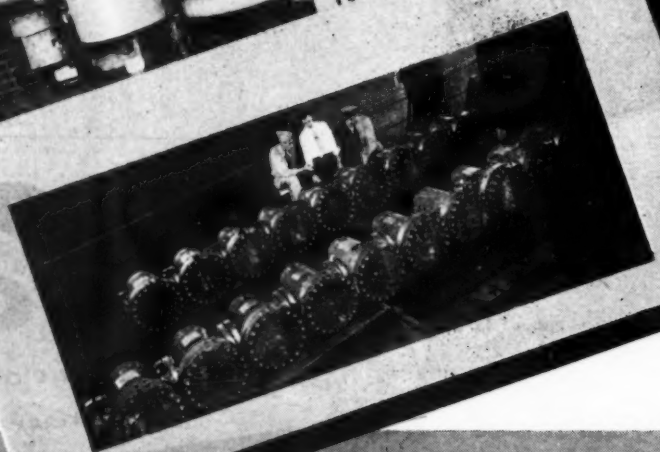


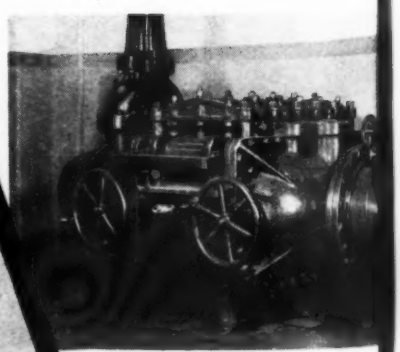
They come large. This is an Elliott 24" Twin Strainer, for constant service. While one strainer basket is removed for cleaning, the twin basket takes on the load. No time-out, no let-up in service.

ELLIOTT DESUPERHEATERS

take the superheat out of steam, dependably and without attention. The picture at left shows a close-up of an Elliott desuperheater with pressure reducing station in a power plant. The photo below illustrates a group of Elliott desuperheaters on hydrostatic test receiving final okay by Elliott and Coast Guard inspectors. These are intended for use on tankers where they reduce steam temperatures from 750 to 500°F., which is safely below the flash point of petroleum products. All ships in the entire tanker program are protected by these Elliott desuperheaters. Full details on request.







Another type of Elliott Twin Strainer. This is a 16" job, in a public utility station. Pressure gage tells when a strainer basket needs cleaning.

STEAM TURBINES • GENERATORS

MOTORS • CONDENSERS

FEEDWATER HEATERS AND DEAERATORS

essentials in plant operation

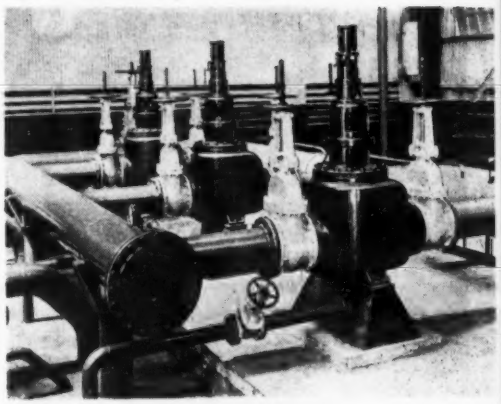
ELLIOTT STRAINERS

There are larger and more spectacular units in the power plant than strainers—but none more essential. Ashore or afloat, their job is vital.

Elliott strainers make liquids safe—service water, cooling water, lubricating oil, fuel oil. They stop any foreign matter or sediment that gets past trash racks or into oil supply. They individually protect water-using apparatus, pumps, valves, bearings, pistons, burner nozzles. And in the process industries their function is even broader.

From the single strainer with one basket, to the self-cleaning unit that needs no attention, Elliott strainers are made in all required types and sizes, and are in service by the thousand.

Have you a problem concerned with the clearing of liquids? Call upon "Strainer Headquarters".



Elliott Self-Cleaning Strainers in a steel mill. Widely used for taking quantities of relatively fine dirt from water. A central element revolves constantly, isolating in turn various strainer sections which are flushed clean by back-flow of a small part of the incoming water. No attention required.

Below, large self-cleaning strainers waiting their turn on the test floor.

ELLIOTT COMPANY

Accessories Department, JEANNETTE, PA.

PLANTS AT: JEANNETTE, PA. • RIDGWAY, PA.
SPRINGFIELD, O. • NEWARK, N. J.

DISTRICT OFFICES IN PRINCIPAL CITIES

A-294

STEAM JET EJECTORS • CENTRIFUGAL BLOWERS
TURBOCHARGERS FOR DIESEL ENGINES • TUBE CLEANERS
STRAINERS • DESUPERHEATERS • FILTERS

DIAMOND AUTOMATIC SEQUENTIAL SOOT BLOWERS

Correct Boiler Cleaning Assured and Labor Saved

When a boiler is equipped with a Diamond Automatic Sequential Soot Blower System, all blowers operate in proper sequence and at the right blowing speed. No blower can be overlooked or incorrectly operated by a careless attendant. The automatic operation saves considerable labor cost because it entirely eliminates the need for an operator.

The program panel shown at the right controls both retracting and nonretracting blowers (using air or steam or both as the cleaning medium) arranged in groups. One "start" button controls all groups for the entire boiler, superheater, economizer and air heater. Any group can be operated independently of other groups by simply throwing a switch on the panel. Blowing sequence of the units in any group can also be easily altered to suit changed conditions.

Air Offers Additional Advantages

While the saving in labor and improved boiler cleaning are characteristics of all Diamond Automatic Sequential Soot Blower Systems, those using compressed air as the cleaning medium have the additional advantage of eliminating feed water makeup. This is particularly important where makeup water is a problem. Compressed air has a greater density than steam and therefore provides better cleaning. Experience gained during several years' operation proves that maintenance costs are unusually low and that air cleaning used only 1/3 to 2/3 of the energy from the coal pile that is needed for steam blowing. The soot blower piping insulation is eliminated when air is used for cleaning.

Diamond Automatic Sequential Soot Blower Systems have been in very successful central station use on boilers as large as 900,000 lb/hr units since 1940. Write for further information.

This program panel controls both fixed and retracting blowers (using both air and steam as cleaning medium) arranged in three groups; any desired number of groups can be had when system is designed. All soot blowers are operated in correct sequence and at right blowing speed by simply pushing "start" button.

DIAMOND POWER SPECIALTY CORP.

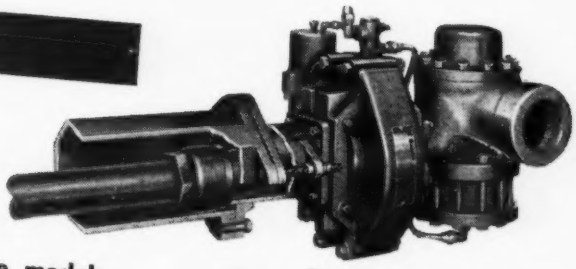
Detroit 31, Michigan

DIAMOND SPECIALTY LTD. • Windsor, Ontario

Air Operated

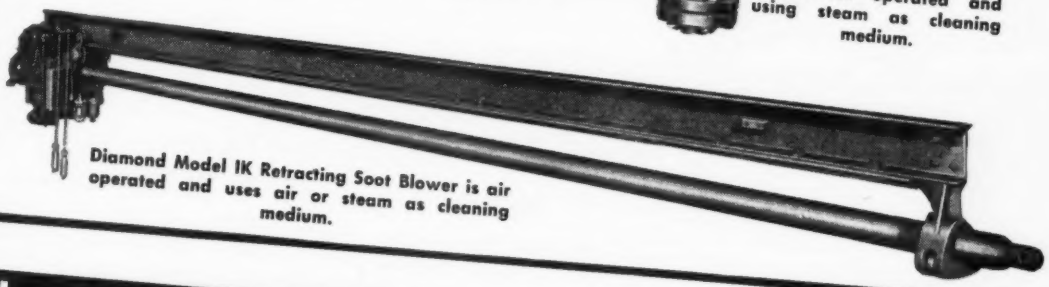
Models of Diamond Soot Blowers that use steam for the cleaning medium as well as those using air for cleaning are operated by air. There are models other than those illustrated that can be air operated . . . for example the Model IF shown below electrically operated.

The operation and control of the various blowers used in Diamond Automatic Sequential Soot Blower Systems are sufficiently flexible to meet the requirements and preferences of the individual steam plant.



Diamond "Air Puff" Soot Blower is air operated and uses air as cleaning medium.

Diamond Model G9B Soot Blower air operated and using steam as cleaning medium.



Diamond Model IK Retracting Soot Blower is air operated and uses air or steam as cleaning medium.

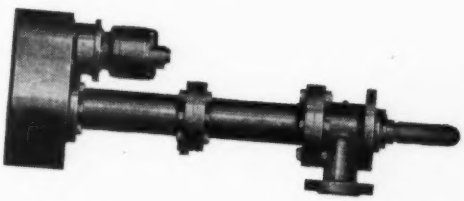
Electrically Operated

Illustrated here are representative models of Diamond Soot Blowers that are electrically operated; both air and steam are used as the cleaning medium. There are other models that can be operated electrically when preferred.

Diamond Automatic Sequential Soot Blower Systems have sufficient variety to permit the selection of those models that are particularly suited to the conditions encountered in the individual steam plant.

Diamond Model G9B Soot Blower electrically operated and using steam as cleaning medium.

Diamond Model IF Retracting Soot Blower electrically operated and using air as cleaning medium.



Diamond "Telescopic" Soot Blower is electrically operated and uses steam or air as cleaning medium.

BULLETIN!

How to Take a Reconversion Inventory of Your Centrifugal Pumps

☛ As new manufacturing equipment becomes more widely available, and as you reconvert your production toward a peacetime basis, you may be faced with an unprecedented problem of inventory-taking.

☛ You may have to determine — more quickly than such a job has ever been done before — the EXACT CONDITION of every piece of existing equipment you propose to use in peacetime production.

☛ For about four years, far greater emphasis has been placed on setting production records than on keeping maintenance records; condition of equipment is often unknown. Because much equipment has been worked during wartime three and four times as many hours a year as in peacetime, calendar age may mean nothing. Much equipment has, through necessity, been mis-applied. And repair has often depended on American ingenuity and baling wire.

☛ Here are some of the standards you need to determine which of your centrifugal pumps: (1) are OK as is, (2) need new parts, (3) will shortly require replacement, (4) need immediate replacement, (5) need reapplication, (6) are obsolete, (7) may have parts of second or third-choice materials that were dictated by wartime shortages.

☛ These standards generally apply to all makes of centrifugal pumps; when in doubt on any pump, consult its manufacturer.

1 START YOUR INVENTORY WITH THE RECORDS

Begin your pump inventory with the *history* of *each* pump; you'll save much time and effort . . . you'll be guided quickly to the units which most need attention. Written records or the mental recollection of foremen and maintenance men are the source of this information.

Check the *master maintenance records* (though in most plants this file is out-of-date and incomplete, because of wartime pressure on production); and get *reports from foremen* (in a small plant, it may be possible to interview each man; in a large plant, it may more efficient to circulate blank forms — such as the "Pump Check List" shown at right).

Then, master mechanic or other member of maintenance department can study these records for: evidence of recurring trouble; misapplications (wrong capacities, wrong motors, wrong type of pump); obsolete equipment (usually indicated by excessive power consumption or excessive maintenance).

NOTE: Wartime restrictions on the use of certain critical materials in pump manufacture made necessary the use of substitute grades in *all* centrifugal pumps made in the United States after May, 1942. If *purchase records* reveal the acquisition of any pumps since that time, inspection of impellers, sleeves, wearing rings, and coupling parts may reveal more than normal wear.

• • •

2 CHECK PUMPS IN OPERATION

After checking the records, watch the units in action. Check for:

Capacity, efficiency, and head. Note the quantity of liquid delivered, the power consumption, and the net head measured in feet. Do these values approximate the ratings stated on the data plate? If not, something is wrong.

Suction lift. Has suction lift increased beyond limits for which pump was purchased? If so, performance may be impaired. Usual maximum for cold water is 15 feet. Inspect for clogged foot valve or screening.

Alignment of motor and pump shafts. Check this with a straightedge and feeler gauge.

Bearing temperature. Internal heat should not exceed 170°F (75°C).

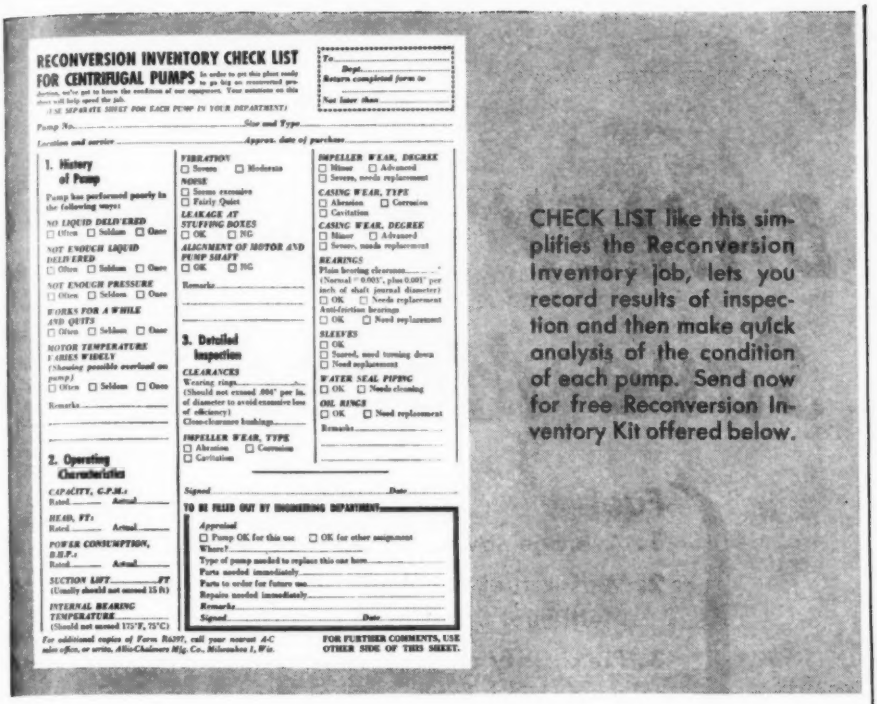
Degree of leakage at stuffing boxes. There should always be *some* . . . experience alone can tell you how much for each pump.

Excessive Vibration or Noise. Has there been a marked increase?

• • •

3 CHECK THE PARTS

To disassemble pump for detailed inspection, you'll need the usual tools, including wrenches, soft hammer, inside and outside micrometers, calipers, steel rule, and feeler gauges.



RECONVERSION INVENTORY CHECK LIST FOR CENTRIFUGAL PUMPS

CHECK LIST like this simplifies the Reconversion Inventory job, lets you record results of inspection and then make quick analysis of the condition of each pump. Send now for free Reconversion Inventory Kit offered below.

Procedure for disassembly and detailed inspection:

1. Shut off pipe valves and disconnect motor current. Remove nuts and lift off upper half of pump casing.

2. Examine *wearing rings* and *close-clearance bushings*. With feeler gauge, measure clearances between stationary and rotating parts. (If a lip on the wearing ring makes it impossible to measure clearance with feeler gauge, remove rotor and measure the two diameters; calculate difference to find clearance.) Maximum clearance is 0.004 in. per inch of diameter to prevent excessive loss of efficiency.

3. Inspect *impeller* (rotor, or runner) for wear. This may be one or more of three types:

a. Abrasion — wear by bits of grit or the like in the pumped liquid. Check for this with sediment test — let a quantity of the liquid stand in a glass; examine any resulting sediment for abrasive matter.

b. Corrosion — eating-away by chemical action. A chemical laboratory analysis of the pumped liquid vs the material of the impeller will reveal whether this is your cause of impeller wear. (If you have no chemical laboratory of your own, Allis-Chalmers will be glad to handle this analysis for you. Address a sample of liquid and details of use to Centrifugal Pump Dept., Allis-Chalmers, Milwaukee.)

c. Cavitation — localized pitting; usually indicated by a "pinging" or "cracking" sound when pump is in action; usually means too high a suction lift.

If wear has reduced the impeller blades to half their original thickness, a spare impeller should be ordered and kept on hand. (Original thickness may be found by measuring an unworn section).

4. If impeller is worn, check also the *casing*, for the same causes may produce the same effects here. Check casing thickness (usual way is to measure through an available opening); here again, reduction to half the original wall thickness may be dangerous.

5. *Measure bearing clearances* for wear. If sidewise "play" of the impeller shaft is noticeable, remove bolts and upper halves of bearing housings; dismantle bearings and measure their clearances with feeler gauge to determine if clearance is appreciably more than normal. Normal sleeve bearing clearances may be computed this way: take 0.003 in. as the basic tolerance . . . then add 0.001 in. for each inch of shaft journal diameter.

To examine anti-friction bearings, first clean them thoroughly with kerosene to remove all old grease and dirt particles; then hold inner race and rotate outer race, feeling for roughness of action and listening for noise. Replace overworn bearings; if not overworn, simply flush bearing and replace lubricant of grade recommended by manufacturer.

6. Inspect *sleeves* for scoring or wear. If: (1) grit has entered the packing in the flow of liquid from the water seal piping, or (2) packing has become old and hard, or (3) packing has pulled up too tight, or (4) packing is not getting proper lubrication . . . there will be scoring of the sleeve between the end of the gland and the end of the stuffing box bushing. If this scoring is slight, sleeve can be turned down. Scoring as deep as 1/8 in. on diameter, however, usually calls for a new sleeve. Or if scoring is such that stuffing box cannot be packed or box leaks excessively, no matter how deep the scoring, sleeves must be replaced. Never fail to replace or turn down a scored sleeve; scoring not only wears packing, but may also increase the horsepower input.

7. Check *water seal piping*. If your check of the pump in operation showed no liquid leakage at the glands, and if packing and lantern ring are okay (lantern ring must align with water seal piping outlet), then clean out water piping; it must be clogged.

8. Check oil rings to see that they run freely. Hot bearings may mean stuck rings. Clean out oil grooves.

Having studied each pump's history, noted its operating characteristics, and made a detailed inspection of its essential parts, you can now compare your supply of pumps on hand against known needs for reconverted production.

• • •

ELECTRIC MOTORS, V-BELT DRIVES NEED RECONVERSION TOO!

To speed your reconversion job, Allis-Chalmers has prepared a new *Reconversion Inventory Kit* — fact sheets and check lists on centrifugal pumps, motors, and v-belt drives. A 1814

GET THESE FREE FORMS!

For your supply of Reconversion Inventory Kits, covering centrifugal pumps, motors, and v-belt drives, call your nearest Allis-Chalmers district office or distributor, or write Department 202, ALLIS-CHALMERS MFG. CO., MILWAUKEE 1, WIS.

ALLIS CHALMERS

How BAILEY CONTROLS Save Money

Fuel

1. Average saving as reported by users is 5%.
2. Waste fuel automatically used, when available, by Multi-Fuel firing.
3. Flexibility of control simplifies switching to most economical fuel.

Maintenance

1. Furnace wall repairs reduced by limiting maximum furnace temperature through close control of excess air.
2. Slagging of heating surfaces reduced to a minimum by accurate control of excess air.
3. Feed water pumps protected at low ratings by automatic by-pass control.
4. Possible damage to turbine from water carry-over avoided by feed water control.
5. Damage from excessive steam temperature avoided by proper control of excess air and superheat.
6. Burning of tubes insured against by proper control of feed water and excess air.

Auxiliaries

1. Power required by fans is less since control continuously operates on minimum allowable excess air.
2. Power for feed pumps may be reduced through control of excess pressure by pump speed.

Steam Use

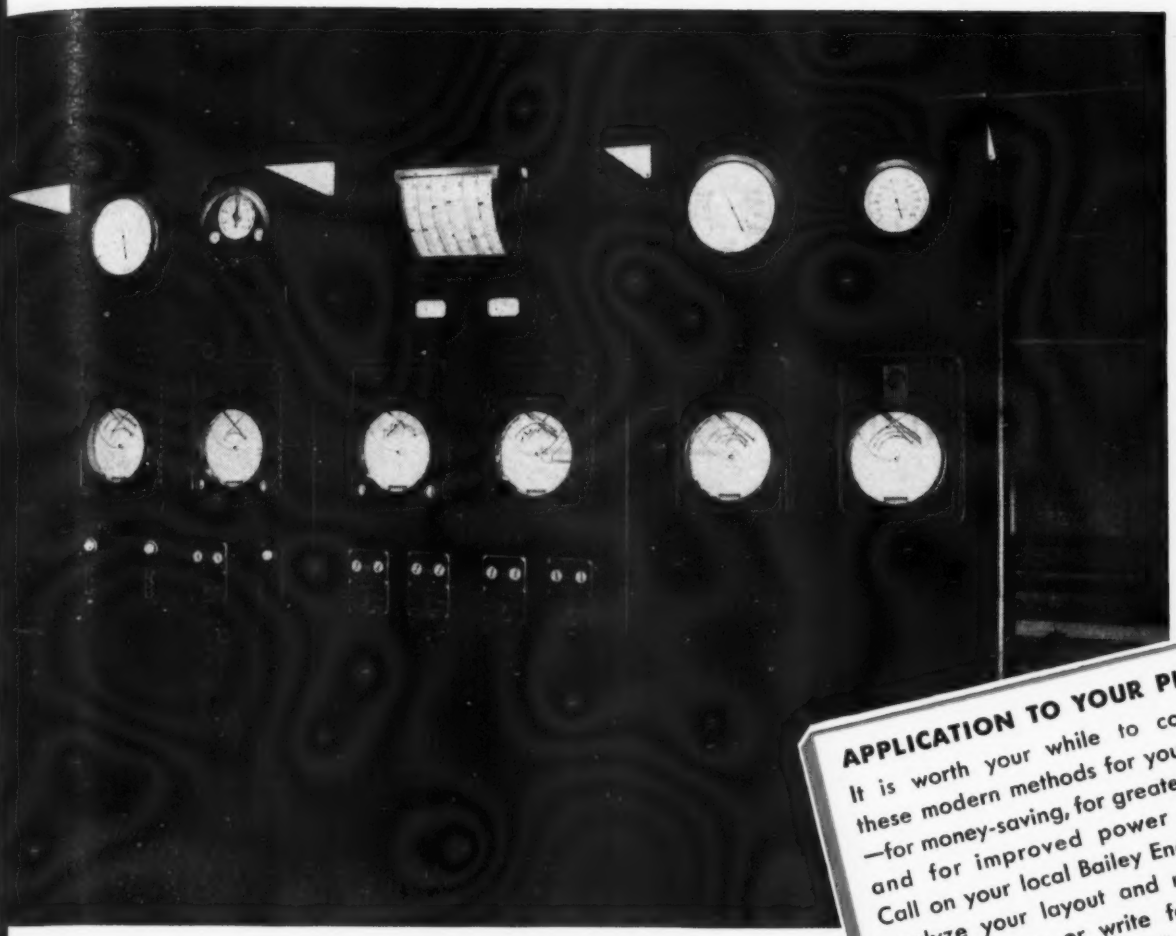
1. Maintains Prime Mover efficiency by supplying steam at design pressure and temperature.
2. Improves process operation by controlling flow, pressure and temperature.

BAILEY METER COMPANY

1036 IVANHOE ROAD • • • CLEVELAND 10, OHIO

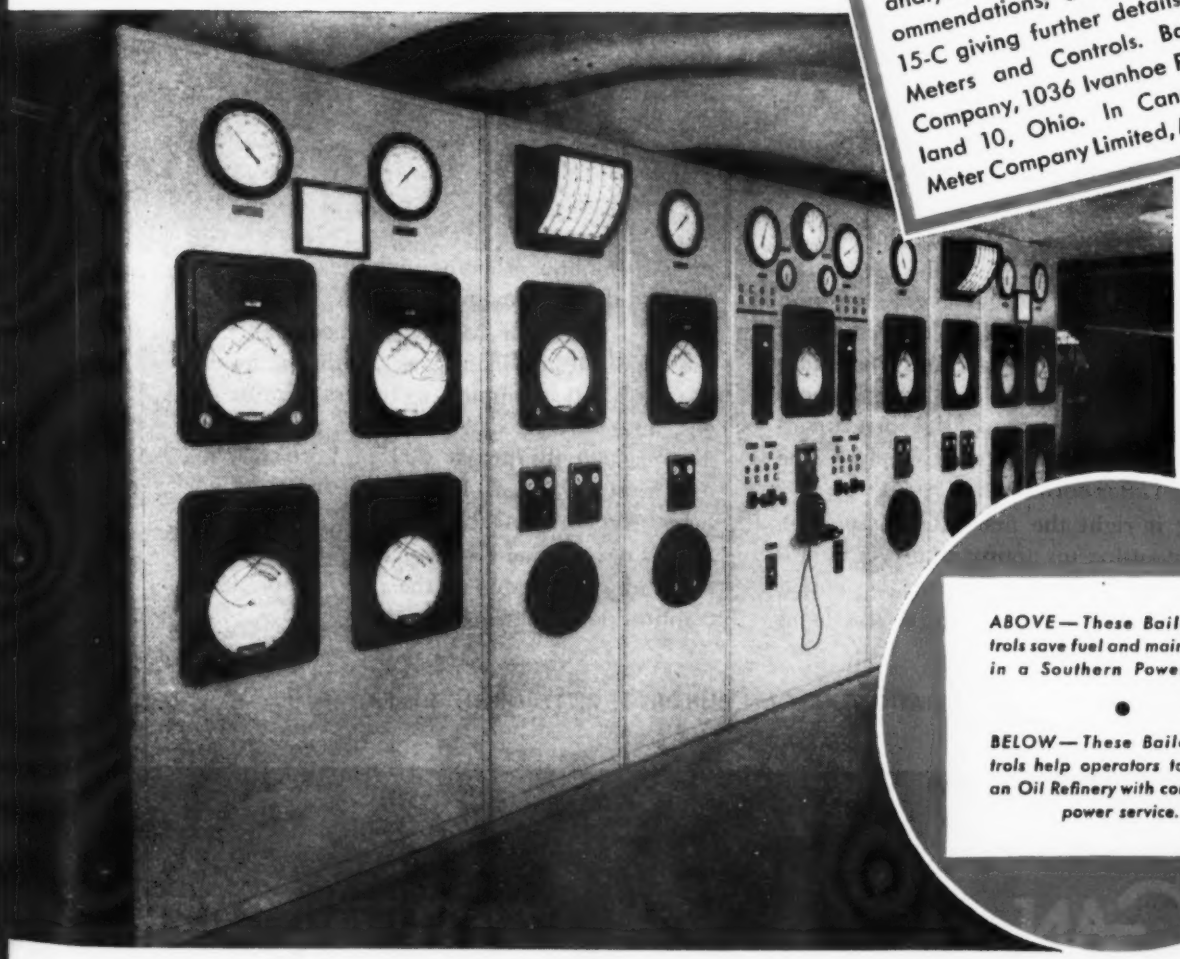
Controls for Steam Plants

COMBUSTION • PRESSURE
FEED WATER • LIQUID LEVEL
TEMPERATURE • FEED PUMPS



APPLICATION TO YOUR PLANT

It is worth your while to consider these modern methods for your plant —for money-saving, for greater safety and for improved power service. Call on your local Bailey Engineer to analyze your layout and make recommendations; or write for Bulletin 15-C giving further details on Bailey Meters and Controls. Bailey Meter Company, 1036 Ivanhoe Road, Cleveland 10, Ohio. In Canada — Bailey Meter Company Limited, Montreal. A-92



ABOVE — These Bailey Controls save fuel and maintenance in a Southern Power Plant.

●

BELOW — These Bailey Controls help operators to supply an Oil Refinery with continuous power service.

Controlling air in proportion to **B.t.u.** input

A report on the Hagan Differential Master Method of Combustion Control

IN THE FIRING of pulverized coal the accurate maintenance of fuel-air ratio has been hampered by such factors as variation in calorific value of coal, and coal feed mechanisms which are affected by moisture content and coal size.

Since it is a known fact that the air requirement per pound of fuel is directly related to its B.t.u. content, it is possible to overcome this difficulty by a simple and *direct* method of control which for the first time employs the steam flow-air flow relationship *correctly*.

Although not universally applicable, where this relationship can be applied the Hagan differential master method uses the boiler unit itself as a calorimeter of heat input and correctly regulates the air in a positive, *direct* manner. This permits the immediate establishment and continuous maintenance of the correct conditions without relegating the principle to the position of an after correction.

By doing it right the first time there is no necessity for setting up approximate conditions to be handled by a lagging corrector system.

The successful accomplishment of this stems directly from the inherent, high speed, sensitivity and stability of Hagan apparatus.

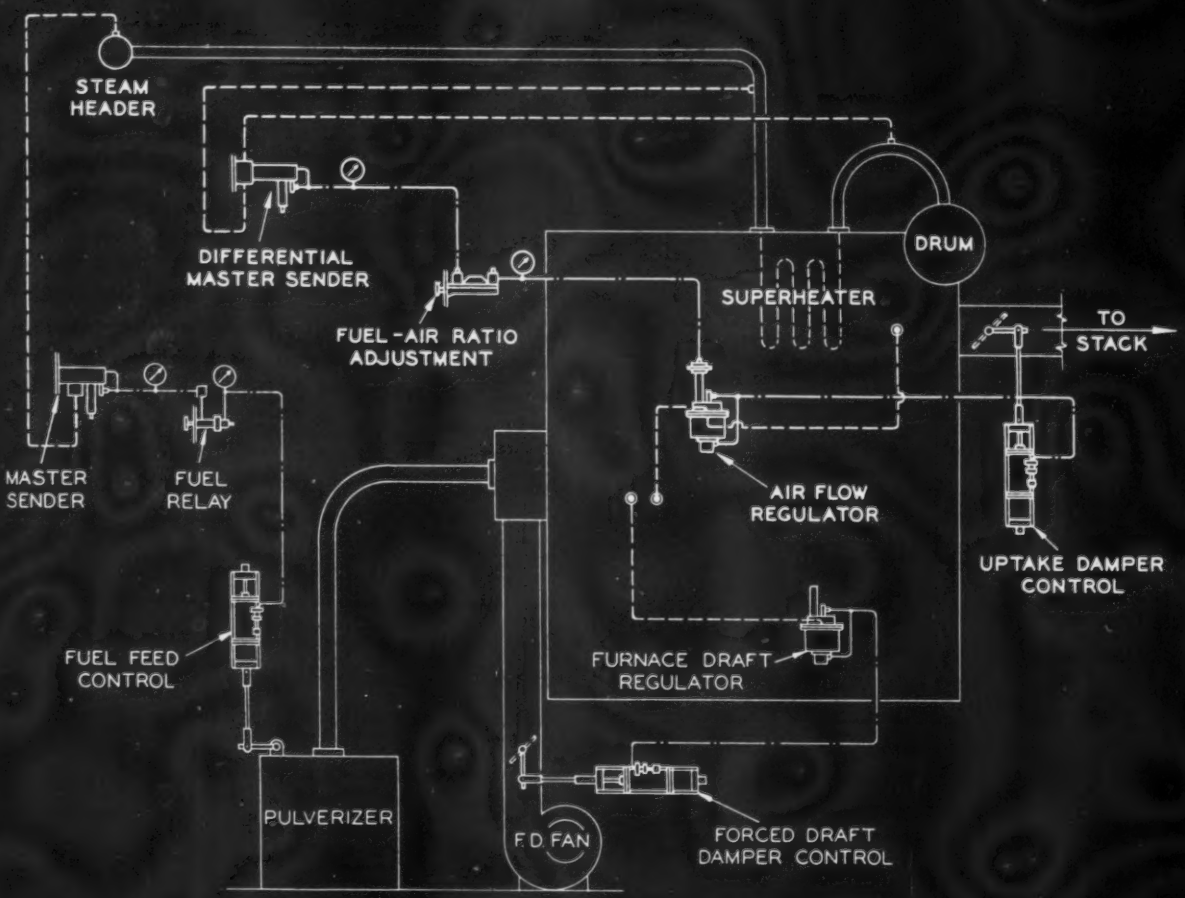
The Differential Master method has been thoroughly tested in service. In the past three years it has been applied to boilers burning oil, gas, and pulverized coal. Boiler sizes ranged from 30,000 lbs./hr. at 200 p.s.i. to 650,000 lbs./hr. at 1800 p.s.i. In every instance, results have been entirely satisfactory.

This development again emphasizes Hagan's continuing leadership in the field of automatic combustion control.

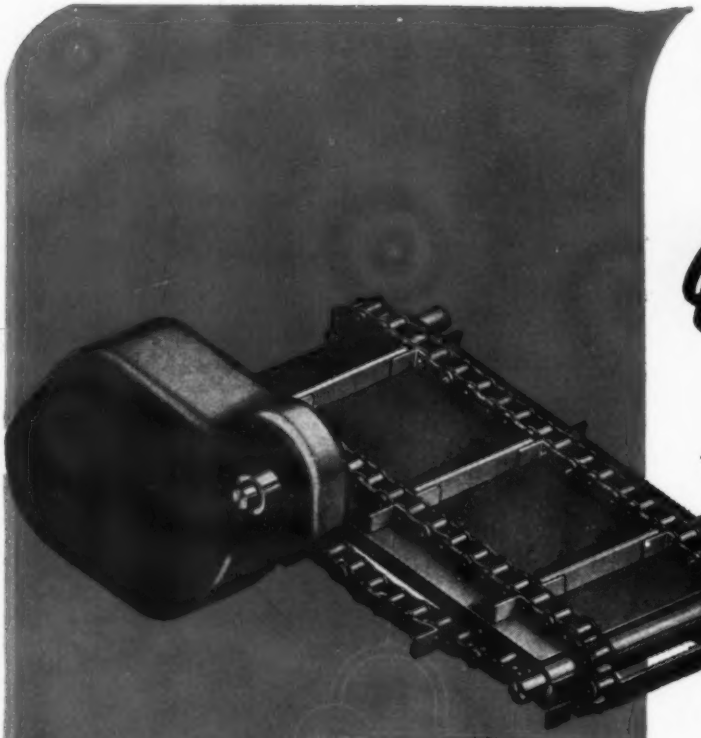
HAGAN CORPORATION, HAGAN BUILDING, PITTSBURGH 30, PA.

HAGAN *Automatic* COMBUSTION CONTROL

The pioneer . . . and still the leader



HAGAN
HALL
BUROMIN
CALGON



YOU CAN HAVE

Quiet Automatic Stoking

YOU'LL hardly believe your eyes or ears when you *see* and *hear* the new Æ Perfect Spread Stoker in operation. You'll see something entirely new and practical in stoker design. You'll see dependable, completely automatic stoking that ends boiler room drudgery and inefficient firing. And you'll be amazed at its *smooth,* unusually *quiet* operation.

You get maximum heat out of all kinds and grades of solid fuels, wet or dry, with the Æ Perfect Spread Stoker. Add to these economies the non-clogging feeder, overthrow spreading, "cross-firing" and other advantages, and you have a good idea how to produce more steam at lower cost.

Other thrifty features and reasons why you should consider this stoker *now* are described in the new Æ Perfect Spread Stoker bulletin. Write for it today.

ALL SPEED DRIVE GETS STEAM UP *FAST*

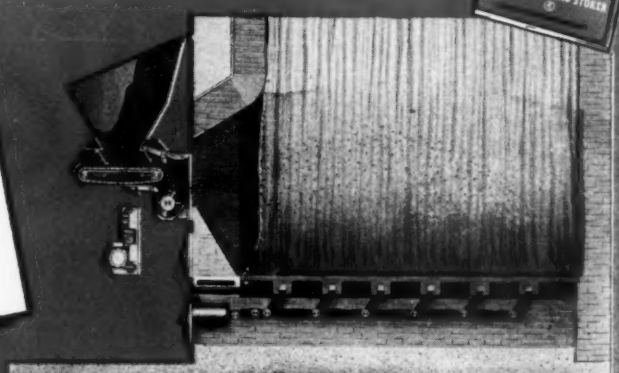
The Æ Perfect Spread Stoker answers steam demands instantly through a novel all-enclosed, adjustable-speed drive on the coal feeder. Automatic controls properly regulate the rate of feed and amount of forced draft to requirements—getting steam up *fast* and keeping it there!

If Your Steam Requirements Call for 175 H. P. up to 200,000 lbs. per hour—

YOU NEED THIS BULLETIN

Write us. 2400 Aramingo Ave., Philadelphia 25, Pa.

Æ PERFECT SPREAD STOKER



Other Æ Products: Æ-Taylor Stokers, Lo-Boy Units, Marine Deck Auxiliaries, Side-Step Wall Fans, Diamond Face Grinders

AMERICAN ENGINEERING COMPANY

PHILADELPHIA 25, PA.

Copyright 1945, American Engineering Co.

SAFEGUARD YOUR DECISION WITH INFORMATION *NOW*

IF YOU'RE PLANNING a new stoker installation, can you afford to make a decision without knowing *all* the latest facts about *all* types of fuel firing equipment? Do you know, for instance, that great improvements have recently been made in Taylor Stokers?

These are *basic* improvements in the tested Taylor Stoker principles of operation that have proved their value many times over during 39 years in hundreds of installations. Stoker design is now vastly simplified for more precise control of coal feed, combustion and ash discharge. Emphasis is placed on features that mean more economical, automatic operation for low cost steam generation under the widest variety of conditions.

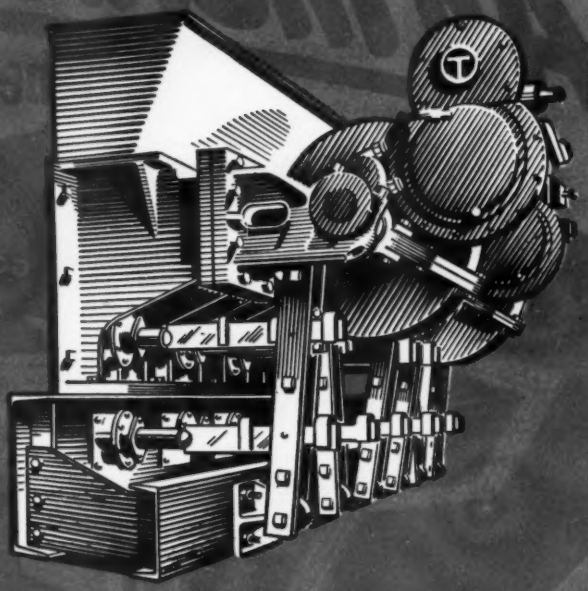
All the advantages of the Improved Type "R" Taylor Stoker are detailed in a new, highly informative booklet. Be sure to have the facts before you when you specify power plant equipment. Write for this booklet *today.*

IF YOUR Steam Requirements Call for 20,000 to 500,000 lbs. per hour—

YOU NEED THIS BOOKLET

Write us. 2400 Aramingo Ave., Philadelphia 25, Pa.

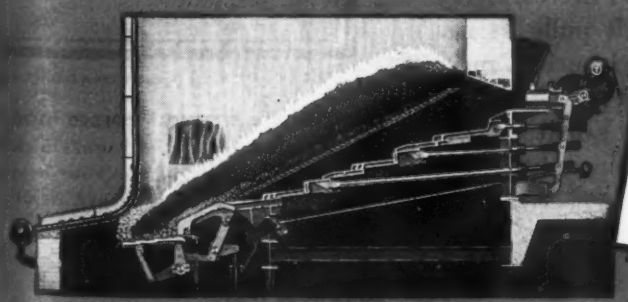
ANOTHER IMPROVEMENT IN THE TYPE "R" TAYLOR STOKER



MORE EFFICIENT FIRING WITH STRAIGHT LINE DRIVE

Complicated mechanisms are eliminated from the improved Taylor Stoker front end drive, which means easier, more efficient regulation of coal feed and fuel bed movement. Simplified straight line drive of coal rams and secondary pushers increases efficiency and "on line" time.

Cooperate with the "National Fuel Efficiency Program" of the U. S. Bureau of Mines.



Æ TAYLOR STOKERS

AIR-COOLED & WATER-COOLED

Other Æ Products: Æ-Parfeet Spreader Stokers, Lo-Bed Units, Marine Deck Auxiliaries, Auto-Flow Fluid Power, Diamond Face Grinders

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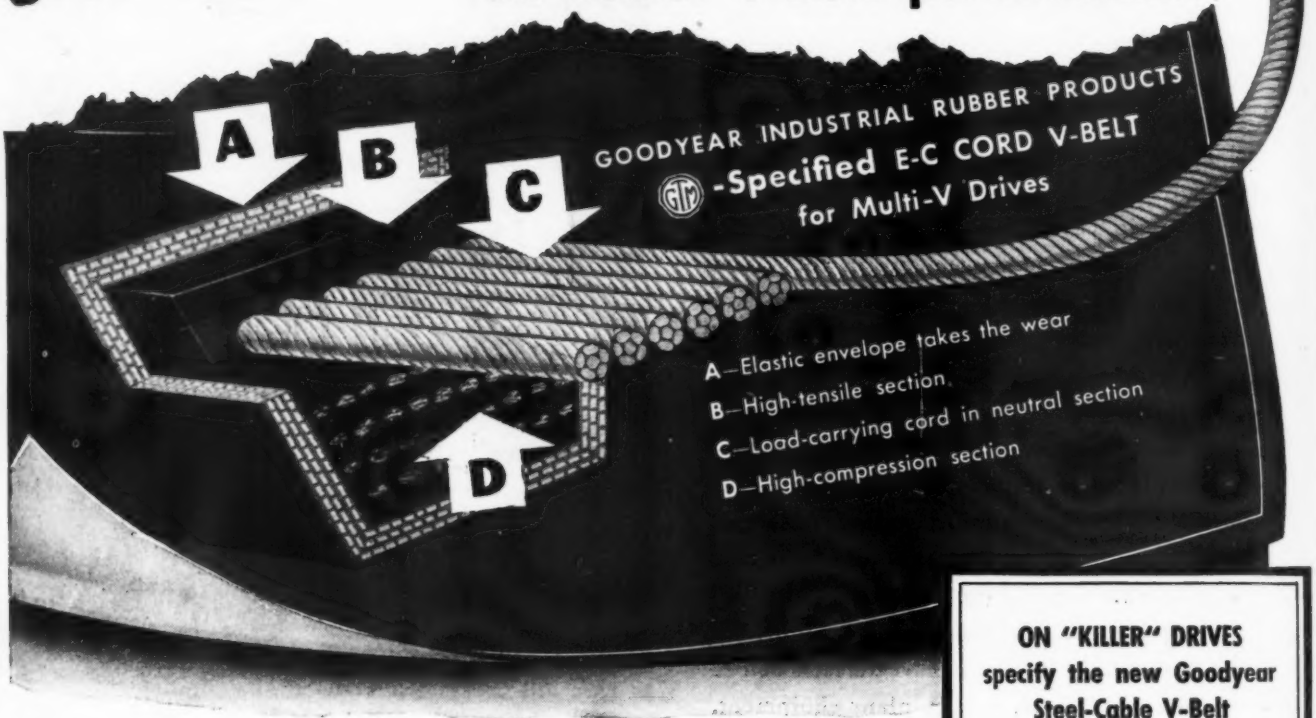
An "Inside" Tip on better V-Belt performance



HERE you see the "inside" reason why Goodyear's time-proved E-C Cord Multi-V Belt is the standout cotton cord belt for high-efficiency performance and long life. Note the large diameter of the tough, endless, heavy-duty cord that sinews this great belt. Comparatively speaking, it is truly ropecord—high in tensile strength and stretch resistance.

This Goodyear-pioneered construction makes it possible to concentrate the load-carrying cord in the neutral section—where it is not subject to either extreme tension or compression in bending around the pulleys. Thus the entire strength of the cord is employed in pulling the load—not sapped by internal friction, buckling or distortion. Every cord does its full share of work.

Add to this the precision-matching that insures uniform length in every set and it is easy to see why Goodyear E-C Cord belts are the best-balanced belts you can buy for multi-V drives. Every cord in every belt pulls its full share of the load, insuring longer life and maximum power output. Order from your V-belt jobber, or write Goodyear, Akron 16, Ohio, or Los Angeles 54, California.

ON "KILLER" DRIVES specify the new Goodyear Steel-Cable V-Belt

This revolutionary Goodyear development handles drives never successfully powered by V-belts before. Operates at belt speeds ranging from 38 to 9,400 F.P.M. — with negligible stretch, creep or slip. Strength to spare for heaviest shock loads. The ultimate V-belt — nearly THREE MILLION now in use.

E-C Cord—T.M. The Goodyear Tire & Rubber Company

FOR HOSE, BELTING, MOLDED GOODS, PACKING built to the world's highest-quality standard, phone your nearest GOODYEAR INDUSTRIAL RUBBER PRODUCTS DISTRIBUTOR.

THE GREATEST NAME IN RUBBER

GOODYEAR

Yes, Men Make Motors!

NO MACHINE KNOWN can duplicate the skill of Sam Meister, left, of Allis-Chalmers Norwood Works.

Holding an acetylene torch in his right hand, a silver alloy rod in his left, Sam silver-brazes end connections of Allis-Chalmers' "Indestructible Rotor."

Round and round the connections he works — expertly flowing in molten alloy to form a joined structure that can withstand as much heat as though it were a single die-casting.

No machine can do that job — and no machine can fully test how well it is done.

There's only one test . . . wait 5, 10, 15 years and *see.*

And that's the test in which Allis-Chalmers motors have proved over the years that they're *great* motors. That's why you hear it said so often: *"You can depend on Allis-Chalmers Motors!"*

• • •

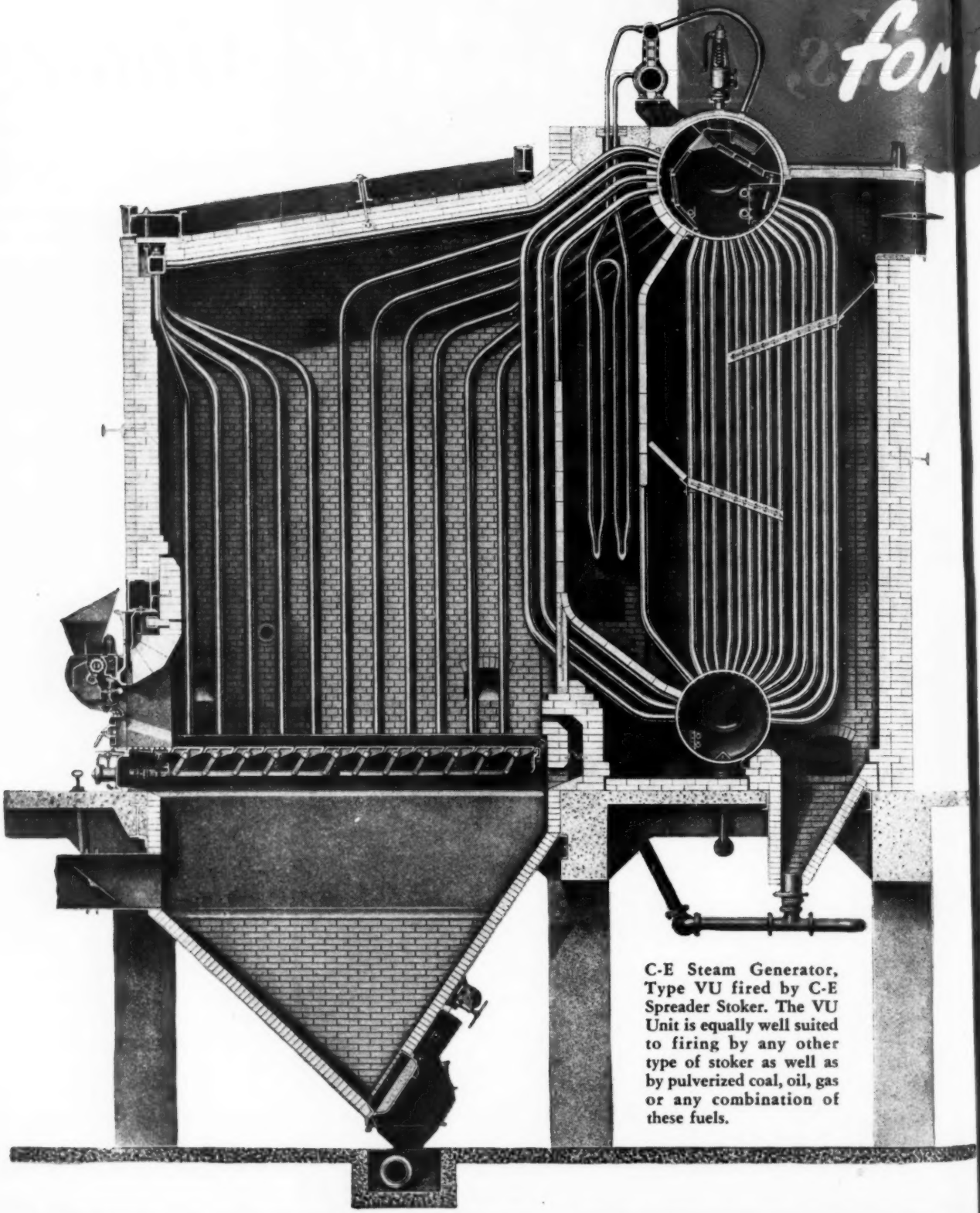
YES, HUNDREDS of Allis-Chalmers men—craftsmen like Sam Meister — know they have a big personal stake in every Allis-Chalmers motor. When they build a great motor for you, they're making a *friend* . . . and they know that's something no company and its workers can have too many of.

Next time *you* need great motors contact our district office. Or write direct to ALLIS-CHALMERS, MILWAUKEE 1, WISCONSIN.

A 1730

A-C WE WORK FOR VICTORY WE MEAN FOR PEACE

YOU CAN DEPEND ON ALLIS-CHALMERS MOTORS



C-E Steam Generator, Type VU fired by C-E Spreader Stoker. The VU Unit is equally well suited to firing by any other type of stoker as well as by pulverized coal, oil, gas or any combination of these fuels.

COMBUSTION

C-E PRODUCTS INCLUDE ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS

HUNDREDS OF PLANTS

this combination of boiler and stoker

is the right answer

When we say hundreds of plants we mean it literally for there's no combination of equipment in the whole C-E line, from 30 hp HRT boilers to million-lb per hr units, that is so well adapted to a wide range of conditions and requirements.

The C-E Spreader Stoker will burn satisfactorily the high ash, high volatile coals of the Pacific Coast region, the sub-bituminous coals and lignite of the West, the free-burning clinkering midwestern coals of Illinois, Indiana, Ohio and Western Kentucky and the caking bituminous coals of the East. Poor quality, fine sizing and other undesirable characteristics are all taken in stride by the C-E Spreader — the nearest thing there is to a universal stoker. With a furnace design properly adapted to the requirements of spreader firing, as it is in Combustion's VU Unit, advantage can be taken of whatever low-priced coals the market affords.

The VU Unit as a whole was initially designed to bring central station performance standards to the average plant. That it met this objective is now a matter of record in hundreds of installations. The quality of its design and construction is perhaps best evidenced by its ability to stay on the line for long periods of uninterrupted service. Translated into economic terms, this means maximum protection against direct and indirect outage losses which in many plants can easily be of substantial proportions. It also means low year-in and year-out maintenance. Coupled with the high efficiency characteristic of VU performance, these advantages add up to low overall steam costs, or, to put it another way, high return on investment.

Installations of this VU — Spreader Stoker combination now have an aggregate capacity of more than 2,500,000 lb of steam per hr. Units ranging in capacity from 20,000 to 100,000 lb per hr are in use in a wide variety of processing and manufacturing industries not only throughout the United States but in South America and in such remote regions as Russia and China. Their performance records are your assurance of efficient, dependable operation.

So, unless *your* steam plant is all that it should be — modern, efficient, reliable *and* able to cope with almost any fuel situation — it is not too early to plan its rehabilitation. As a first step, why not investigate the C-E Spreader fired VU Unit?

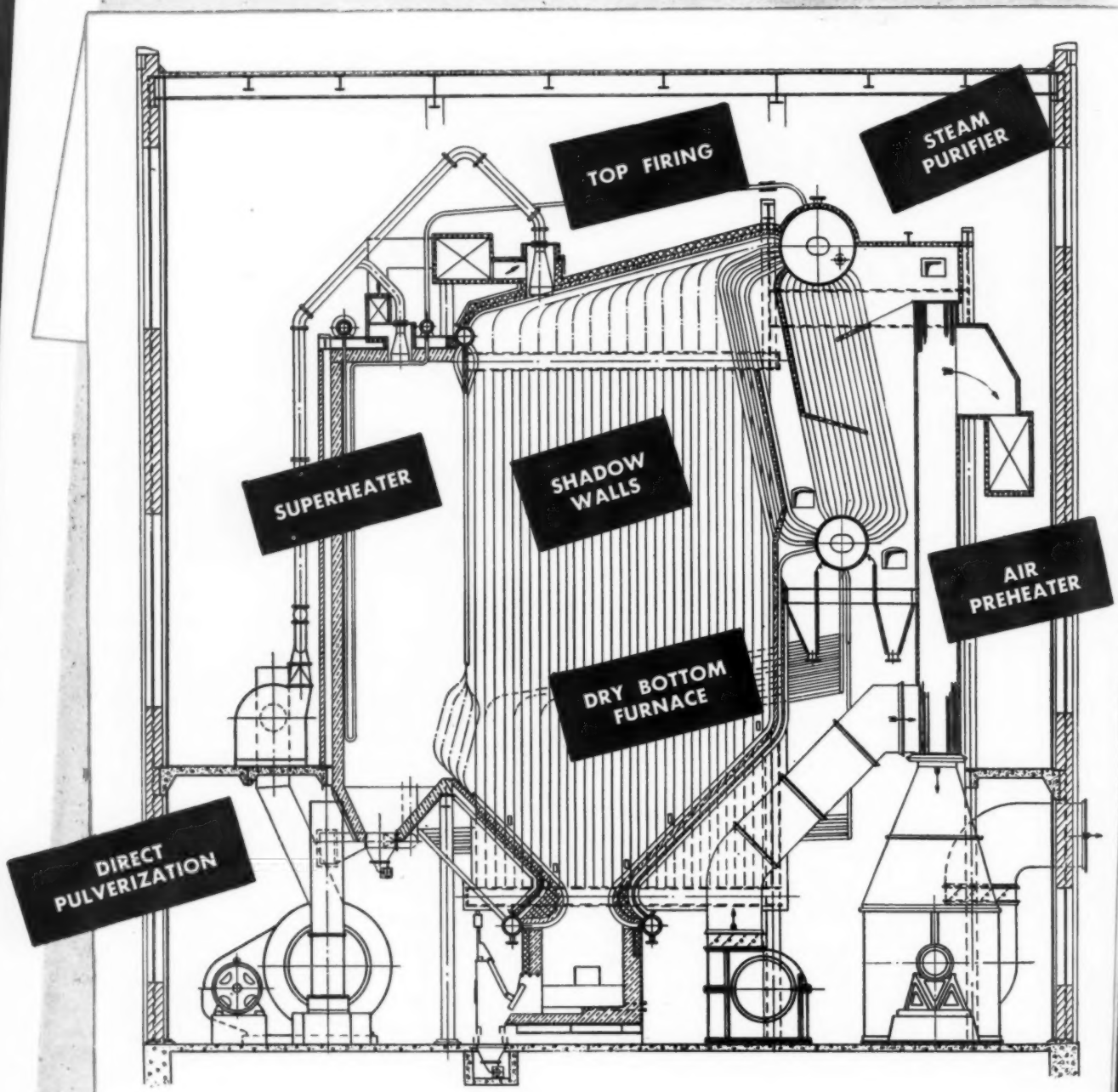
A-8M

ENGINEERING

200 MADISON AVENUE, NEW YORK 16, N. Y.

C-E

ALL STEAM GENERATOR



KVS ENGINEERING

KVS Engineering Service is available for designing and installing complete steam generating plants including pulverizing equipment, burners, fans, coal elevators, bunkers, coal weighing scales, ash conveyors and all essential equipment. Consult KVS on your requirements and have one responsibility.

DESIGNED by KVS

achieve overall high efficiency on a wide range of fuels

Full consideration of the relation of boiler design to fuel selection and fuel economics is given by KVS Engineers in steam generating units. Protection against possible future shortages of suitable fuel is furnished in K.V.S. units by making proper provision in design to permit efficient operation on the lower grade coals having a wide range of characteristics. The unit shown is one of the many K.V.S. designs which assure this protection.

SUPERHEATER

The thermostatically controlled, direct, separately fired superheater, tangent tube division wall, top firing, bottom outlet is an exclusive K.V.S. feature. The unburned fuel passes into the main furnace where the completion of combustion takes place. This feature provides radiant heat for the Superheater and adds to the efficiency of the boiler furnace.

SHADOW WALLS

K.V.S. Water Walls provide increased heat absorbing surface, assure a clean furnace and avoid refractory maintenance.

TOP FIRING

Better control of combustion is obtained by this method of firing and assures the coverage of furnace area with radiant heat.

PERFECT PULVERIZATION

With the K.V.S. Integral Drive Tube Mill, a continuous dependable supply of superfine pulverized coal, regardless of the quality of coal available, is assured at low cost for power and maintenance.

AIR PREHEATER

The tubular air heater is an integral part of the boiler forming the rear enclosure. Gases of combustion enter at the top and leave at the bottom, thereby assuring minimum maintenance.

STEAM PURIFIER

This K. V. S. development provides a highly efficient means of drying and purifying the steam. Less than one-half of one part per million of impurities is carried over.

DRY BOTTOM FURNACE

This feature in K. V. S. design eliminates concentration of heat and thereby minimizes tube failure.

Kennedy Products — Kennedy-Van Saun Mfg. & Eng. Corp. — New York USA — Service

Kennedy-Van Saun

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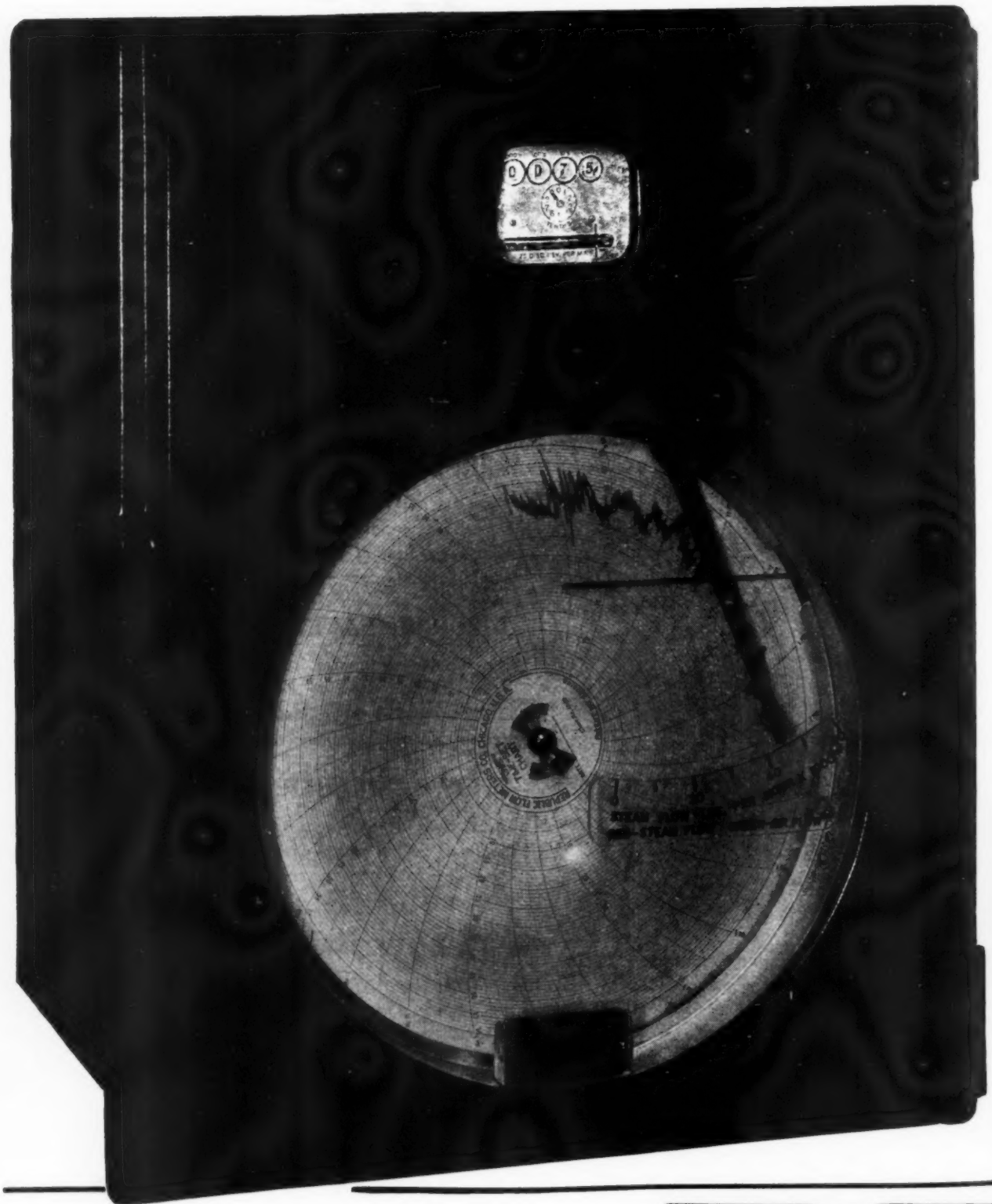
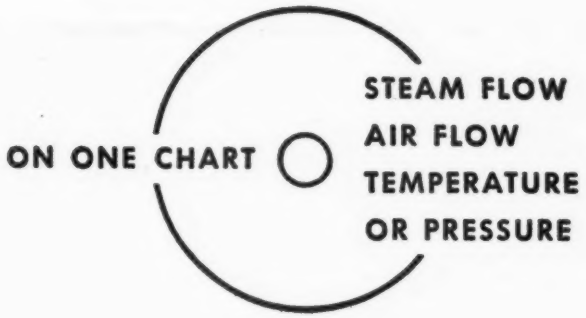
Write for Data on the



REPUBLIC
INSTRUMENTS
AND CONTROLS

Republic Boiler Meter



● The new Republic Boiler Meter provides, in one instrument and on one chart, all the essential information concerning boiler performance regardless of the size or type of boiler, kind of fuel or method of firing.

The meter indicates, records, and integrates steam flow from the boiler and records rate of air flow for combustion. When the correct amount of air for maximum combustion efficiency is being supplied the air flow pen will record coincident with the steam flow pen, regardless of the load being carried by the boiler.

A third pen recording flue gas temperature (or steam pressure) can be added thereby providing the operator with complete information, on one 12-inch chart, relative to the performance of the boiler at any given time.

The Republic Boiler Meter is primarily a boiler operating guide. The two records, steam flow in red and relative air flow in blue, tell the operator instantly whether correct combustion and furnace conditions exist, thereby enabling him to correct faulty conditions when they occur.

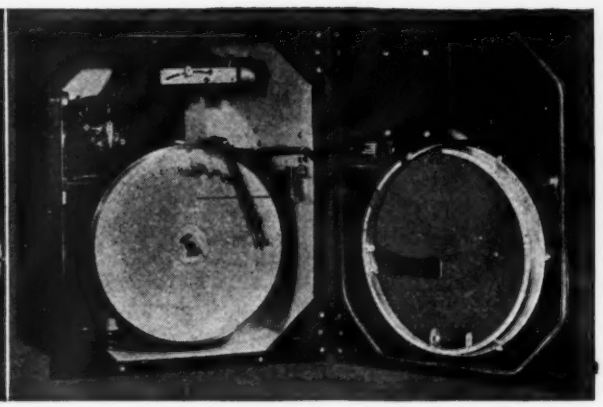
The Republic Boiler Meter consists of a standard Republic electric steam flow recorder and integrator and an oil sealed, bell type air flow element.

The air flow element consists of an oil sealed bell in a sealed chamber. The motion of the bell is transmitted through a diaphragm seal. This arrangement permits the use of a single bell—the high pressure being applied to the top of the bell and the low pressure under the bell. This arrangement also excludes air and dirt from the oil. The motion of the bell is transmitted to a cam system which extracts the square root, or when adjusted for a particular installation, compensates for chimney action and variable excess air requirements. The air flow pen is attached to the cam system with an adjustable linkage which permits changing the steam flow air flow ratio as conditions may require.

The entire operating mechanism is housed in a rugged steel case and can be easily removed as a single unit by merely loosening two anchor bolts and disconnecting the two air connections. The meter may be either wall mounted or flush mounted on a steel panel. *Write for Bulletin No. 420.*

Meter assembled as one unit on rack ready for calibration.

Meter assembly can be easily removed from the case.

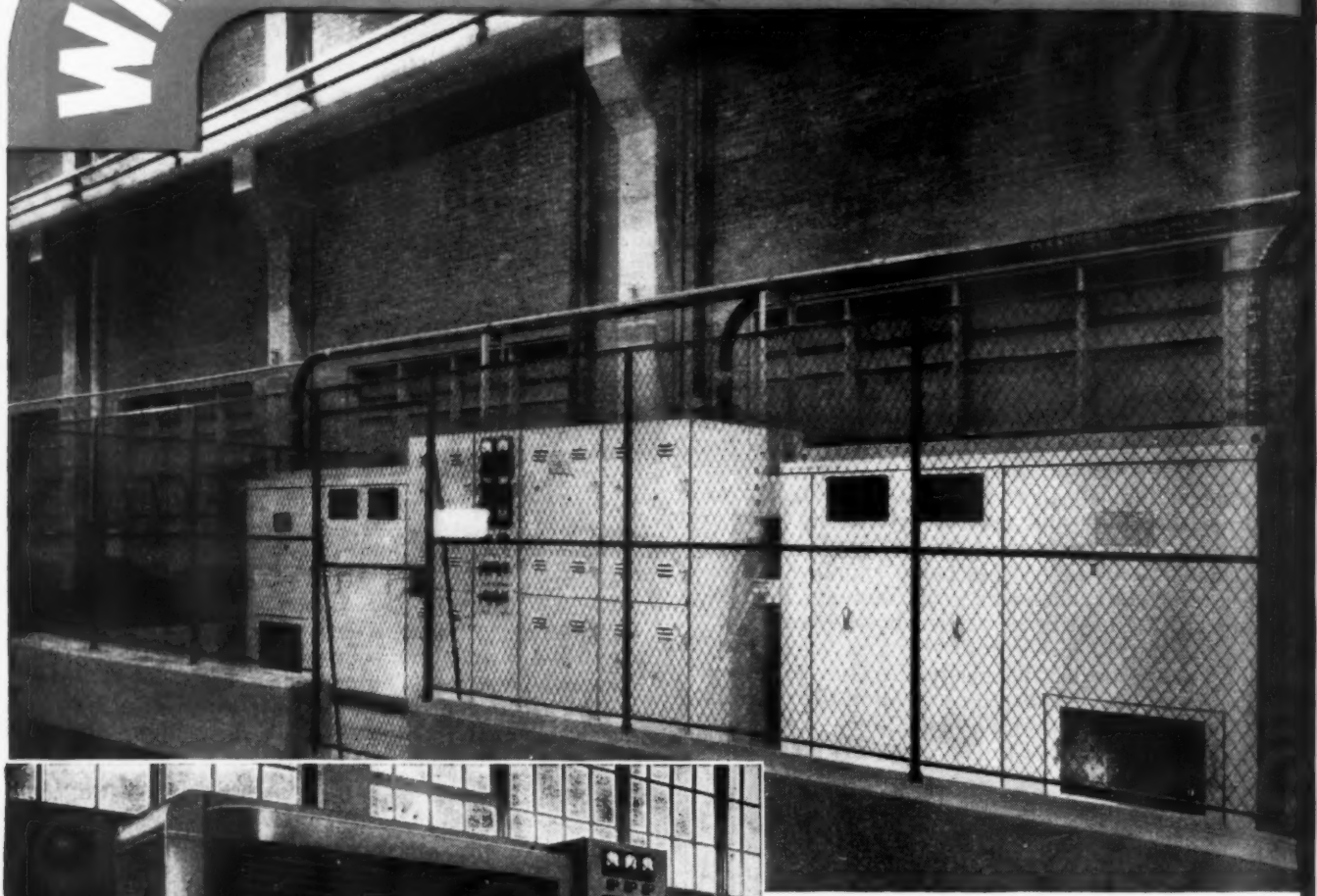


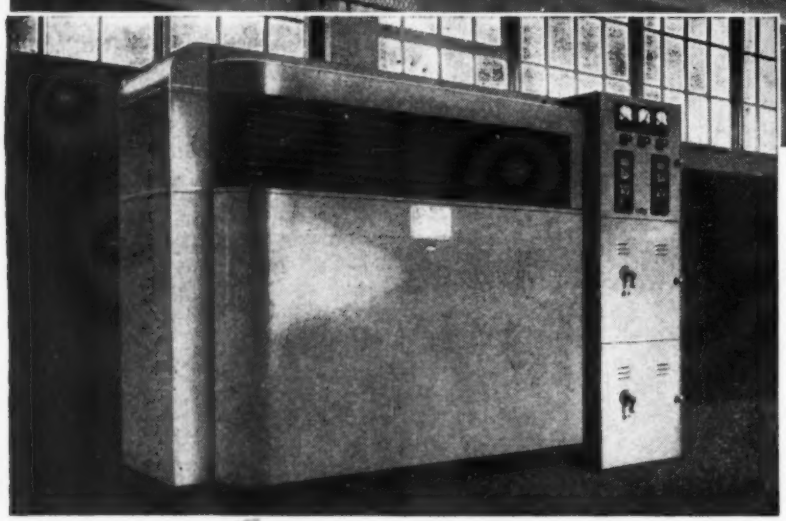
Meter with door open showing accessibility of all adjustments and working parts.

Republic Flow Meters Co.

2222 Diversey Parkway • Chicago 47, Illinois

WHY G-E dry-type transformers



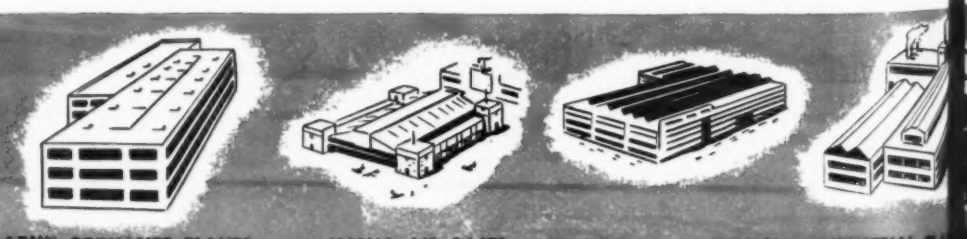


At a light-metals plant in Pittsburgh—This 2000-kva, 4160- to 480-volt unit substation is one of five such installations at this plant. (The enclosing fence is to prevent tampering with controls.) Compare the metal-enclosed construction of this dry-type equipment with conventional open-screen designs.

Good looks is a standard feature of all G-E dry-type, load-center unit substations. Such units are "naturals" for distribution revamping programs because, if you so desire, you can buy them one block at a time and still end up with a completely modern co-ordinated system—a system in which the self protection of each substation confines most troubles to a small area and prevents crippling plant outages. Available in ratings from 200 to 2000 kva, 601 to 15,000 volts.

GE

DRY-TYPE TRANSFORMERS AND UNIT SUBSTATIONS



ARMY ORDNANCE PLANTS NAVAL AIR BASES AIRCRAFT FACTORIES INDUSTRIAL PLA

IN USE FROM COAST TO COAST

...have won wide acceptance

1. These ultramodern, dry-type distribution transformers are designed to meet AIEE Standards No. 1 for Class B insulation, with 130 C maximum hot-spot temperature in a maximum ambient of 40 C. They also meet ASA Standards C-57.1, which limit the observable temperature rise to 80 C.

2. Because they meet industry standards for hot-spot temperature, G-E dry-type transformers are better suited to handle emergency overloads than units designed to higher temperatures. Longer life under severe service conditions is the inevitable result.

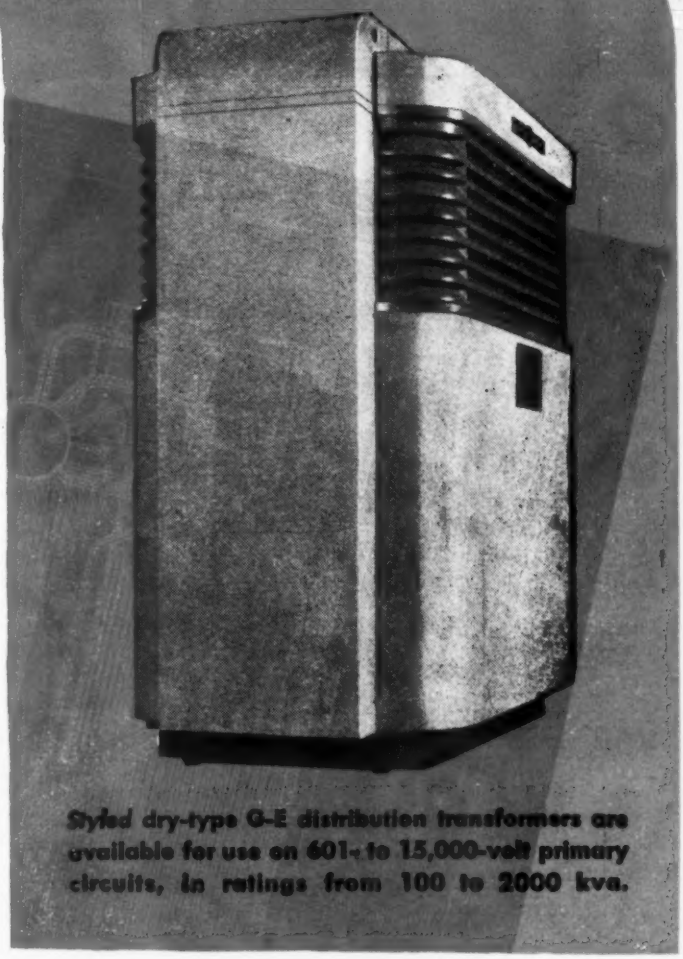
3. Housings are designed for utility, and are attractive in appearance.

4. Completely metal-enclosed construction prevents rods and wires from being accidentally pushed into the live parts.

5. There are no exposed live parts, such as bushings, that would lessen safety and make a fence mandatory.

6. Cable terminal compartments are completely removable, so the high-voltage and low-voltage cables can be made up and the unit slid into place between them without the use of a crane or elaborate hoisting and jacking facilities.

7. Transformer side plates are readily removable to facilitate inspection and cleaning of the core and coils.



Styled dry-type G-E distribution transformers are available for use on 601- to 15,000-volt primary circuits, in ratings from 100 to 2000 kva.

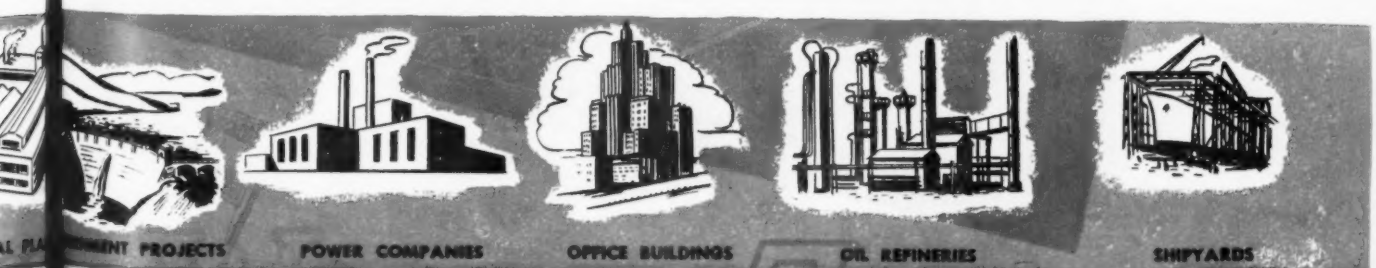
If you prefer dry-type designs, you will find these ultramodern dry-type transformers ideal for modernizing your plant's power system.

Their trim good looks, their safety, and ease of installation make dry-type units "at home" anywhere in your plant.

They fit right in with the economic good sense of *load-center power distribution*, which offers savings in installation cost, power, and assurance of full voltage at every lamp and machine.

When these transformers are a part of unit substations, the interrupting capacity of the substation switchgear section is exactly matched (electrically, mechanically, thermally) with the transformer capacity. It is adequate for even the most severe short circuits.

Ask for Bulletin GEA-3592A (load-center unit substations); Bulletin GEA-3714B (dry-type distribution transformers). *General Electric Company, Schenectady 5, N. Y.*



GENERAL ELECTRIC

402-88-5100

BUY WAR BONDS

CENTRAL ILLINOIS

FOSTER

ELECTRIC AND GAS CO.

ROCKFORD GENERATING STATION

● Two large steam generators for spreader type stoker firing are being built by Foster Wheeler to meet the particular conditions pertaining to this station.

The requirements are:

215,000 lb. per hr. (peak load)
650 lb. per. sq. in. pressure
830 deg. F. final steam temperature
85% (approximate) efficiency
Fuel—Illinois coal

These units are of the 3-drum type with Full Water Cooled Furnaces, Convection Superheaters, Condenser type Superheat Control, Extended Surface Economizers and Two-pass Tubular Air Preheaters, as shown on the opposite page.

Selection of this design was made after thorough study by the operators and their consulting engineers of the economic and engineering problems involved.

The choice was also influenced by the exceptional performance of similar installations operating with a comparable grade of fuel.

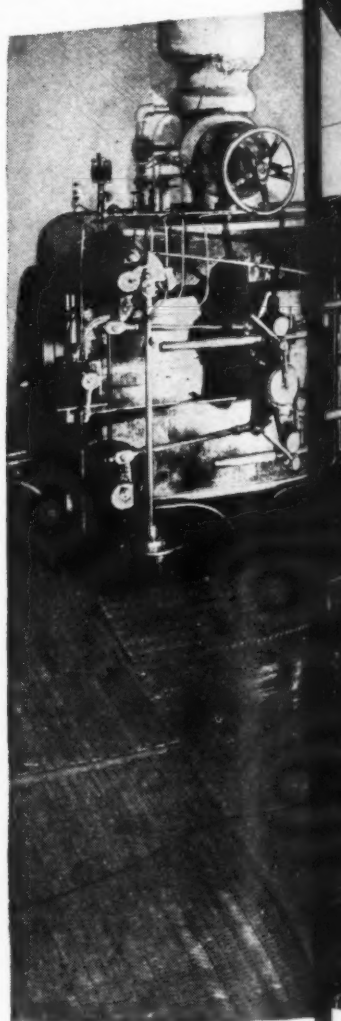
FOSTER WHEELER CORPORATION

165 BROADWAY ● NEW YORK 6, N. Y.

WHEELER

You say I can REDUCE

Yes . . . if you use the



TWO QUALITIES are essential to assure effective steam cylinder lubrication with minimum oil consumption. The oil must (1) *atomize completely* and (2) *adhere to cylinder walls.* You get these benefits in all Texaco steam cylinder oils.

Selection of the right oil for your steam engine depends on the particular operating conditions of your installation.

That is why there is a complete line of Texaco steam cylinder oils—one to meet the requirements of every operating condition in every type of steam engine, new or old.

Whatever the operating conditions, there is a Texaco steam cylinder oil to give you quiet operation and effective lubrication with low oil consumption. If your steam is re-used for processing, Texaco has oils specially developed to assure rapid separation from the exhaust.

To assist you in selecting the right oil for your particular steam conditions, Texaco Lubrication Engineering Service is available through more than 2300 Texaco distributing plants in the 48 States. Get in touch with the nearest one, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TUNE IN THE TEXACO STAR THEATRE WITH JAMES MELTON EVERY SUNDAY NIGHT —CBS

TEXACO

REG. T. M.

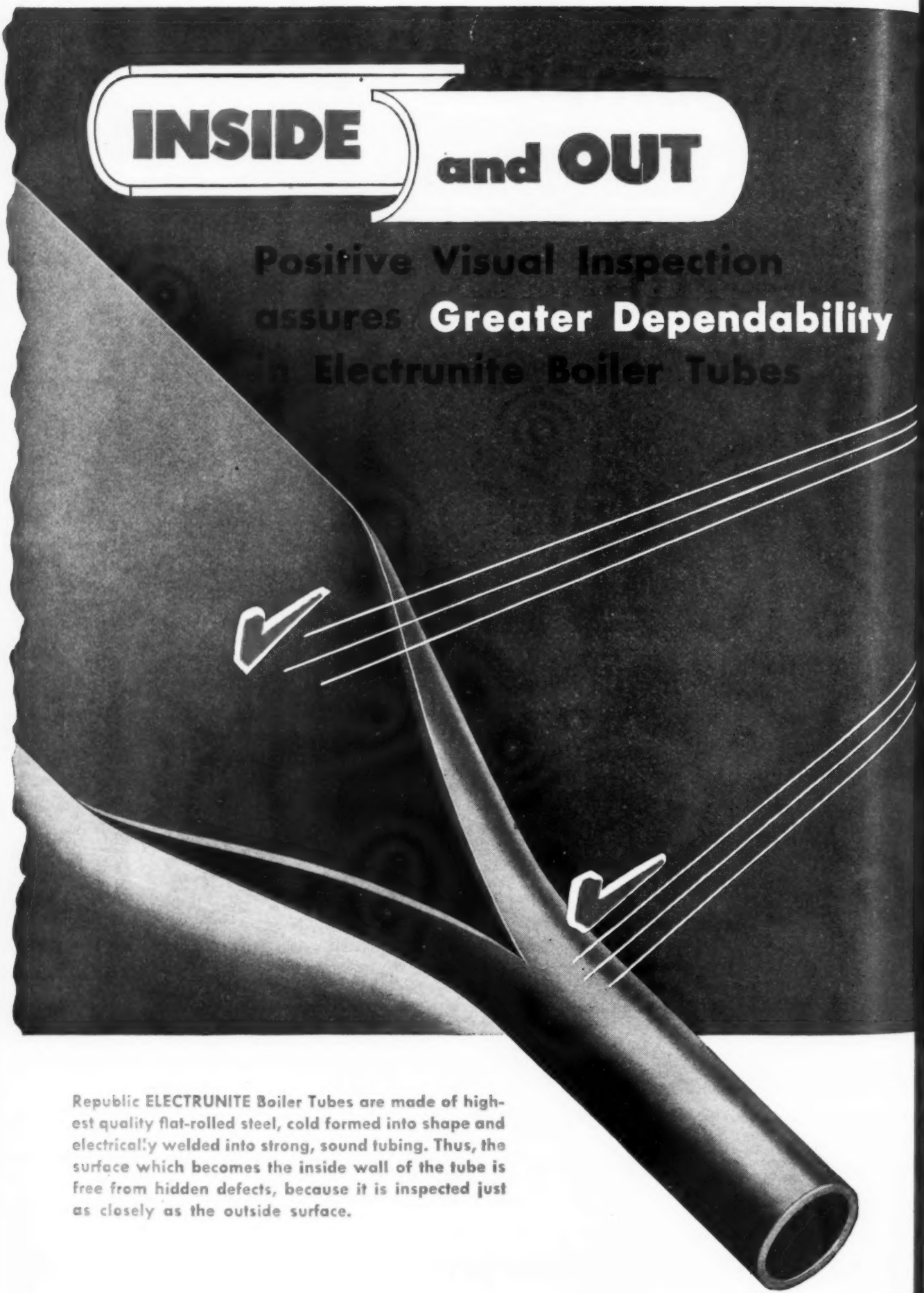
TEXACO

STEAM CYLINDER OILS

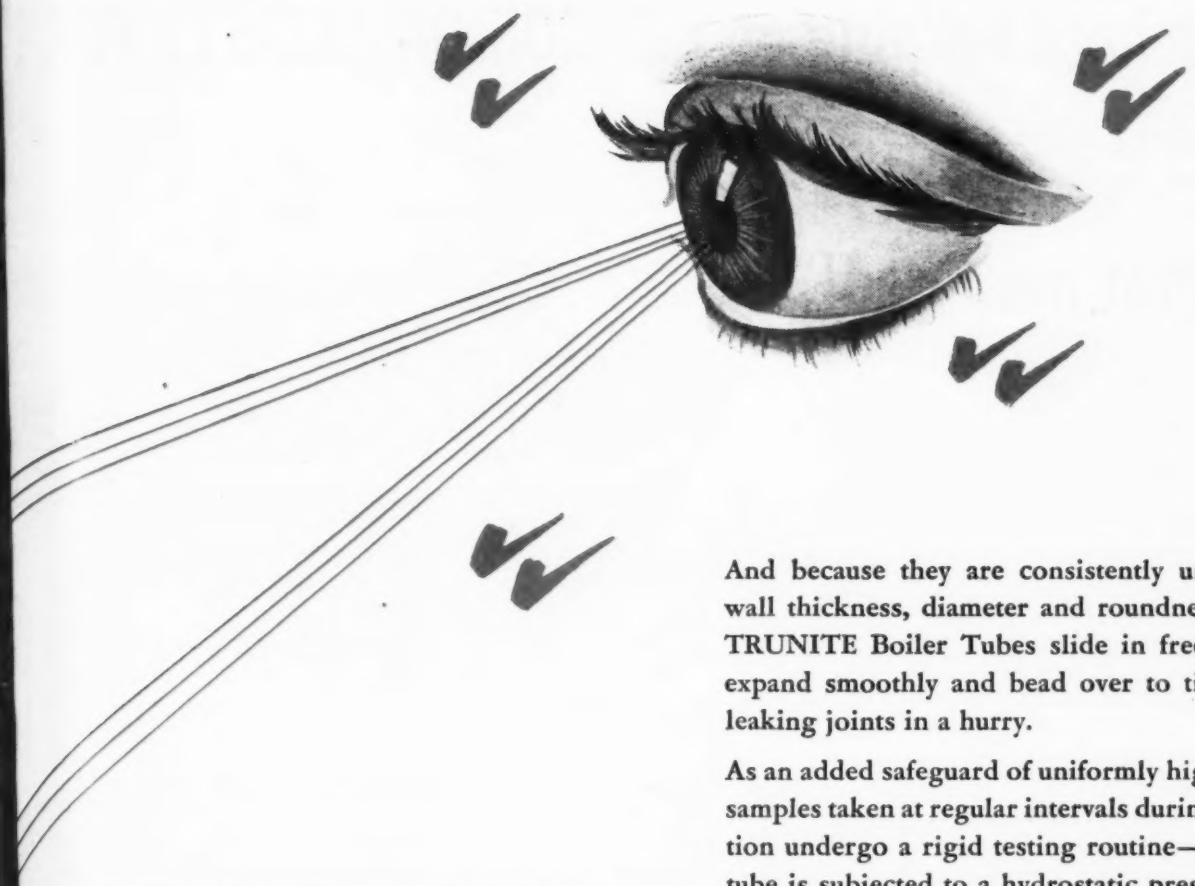
FOR EVERY STEAM CONDITION

INSIDE and OUT

Positive Visual Inspection assures Greater Dependability in Electrunite Boiler Tubes



Republic ELECTRUNITE Boiler Tubes are made of highest quality flat-rolled steel, cold formed into shape and electrically welded into strong, sound tubing. Thus, the surface which becomes the inside wall of the tube is free from hidden defects, because it is inspected just as closely as the outside surface.



● Inside and outside, you are assured of clean, scale-free surfaces throughout every length of Republic ELECTRUNITE Boiler Tubes.

Why? Because ELECTRUNITE Boiler Tubes are cold formed from flat-rolled steel, both sides of which are open to close visual inspection.

But that's not all! There are other reasons why it pays to use Republic ELECTRUNITE Boiler Tubes.

These *modern* boiler tubes speed up retubing. They are free from hard spots—are uniformly high in ductility—because they are full normalized throughout their entire length.

And because they are consistently uniform in wall thickness, diameter and roundness, ELECTRUNITE Boiler Tubes slide in freely, roller expand smoothly and bead over to tight, non-leaking joints in a hurry.

As an added safeguard of uniformly high quality, samples taken at regular intervals during production undergo a rigid testing routine—and every tube is subjected to a hydrostatic pressure, well in excess of code requirements, before it leaves the factory.

ELECTRUNITE dependability is proved by the fact that more than 150,000,000 feet have been installed in all types of steam generating and heat transfer equipment throughout industry.

For more information about ELECTRUNITE Boiler Tubes and the Electric Resistance Weld Process by which they are made, write for your copy of our new brochure.

REPUBLIC STEEL CORPORATION
STEEL AND TUBES DIVISION • CLEVELAND 8, OHIO
Export Department: Chrysler Building, New York 17, N. Y.

Republic
ELECTRUNITE
Reg. U. S. Pat. Off.
BOILER, CONDENSER AND HEAT EXCHANGER TUBES

"Jim kept harping on CORROSION RESISTANCE ...as if THAT was all that mattered!"

"I was doing different 'fishing' last week . . . for a *metal*.

"Hauled in plenty of suggestions, too. Only none of 'em would fit my job.

"Most of 'em had only half the properties I needed. Some had only one. Like Jim's—*all his metal could offer was corrosion resistance.*

"But what good's corrosion resistance if the metal can't stand the load? And, what good is strength if the metal corrodes away before next summer?

"*Sure.* I needed corrosion resistance. But this job also called for a metal that was non-magnetic and strong . . . tough . . . hard as a heat-treated alloy steel.

"And, just to make the problem a little more difficult . . . the metal had to be readily machinable.

"Then . . . someone suggested the INCO Nickel Alloys.

"*That was the tip I needed!*

"All of them had Jim's corrosion resistance, *plus* strength, toughness, hardness and machinability. And each one also had certain *specialized* properties.

"Knowing the properties I needed, it was easy to run down the list and choose the INCO Nickel Alloy that had exactly the combination of properties needed — heat-treatable 'KR' *Monel*.

"It worked as though it'd been made especially for my job!"

A multi-ton unit . . . or a pin-like fastening. Size imposes no limitations when you use INCO Nickel Alloys to build in the "performance" you plan.

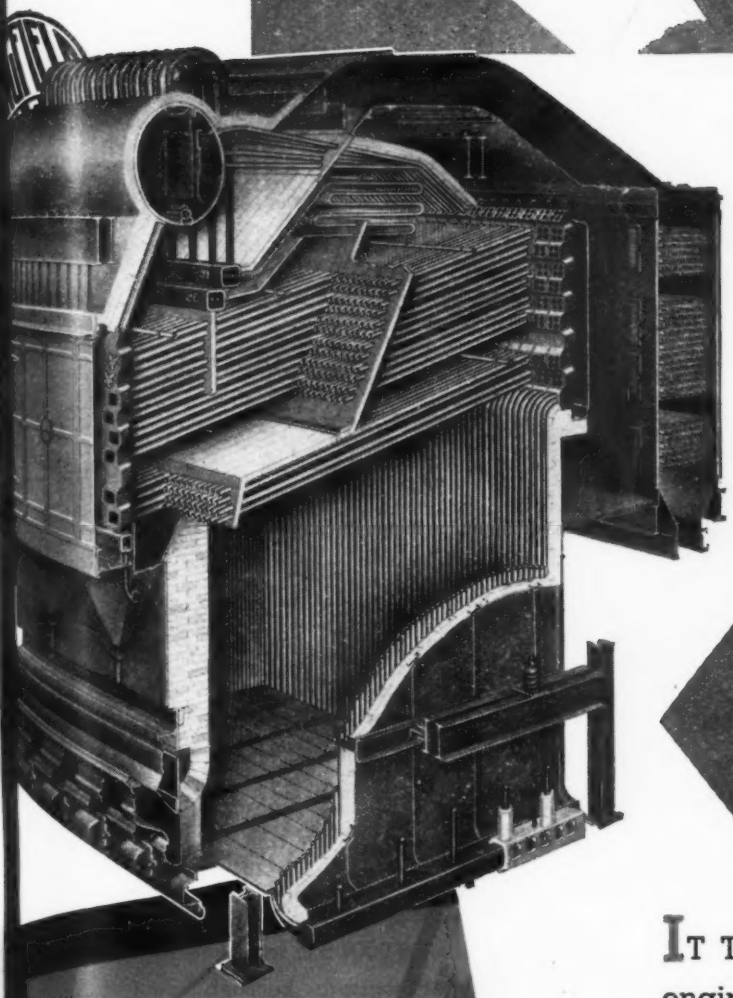
Investigate these alloys whenever you need tough metals for tough jobs. Each offers a different (and hard-to-find) combination of properties.

Tell us the alloy that interests you, and we'll mail more information. Or, send for "List B-100," listing over 100 bulletins which explain the properties and applications of the INCO Nickel Alloys. The International Nickel Company, Inc., 67 Wall St., New York 5, N.Y.

NICKEL (INCO TRADE MARK) ALLOYS

MONEL* • "K" MONEL* • "S" MONEL* • "R" MONEL*
"KR" MONEL* • INCONEL* • "Z" NICKEL* • NICKEL
Sheet . . . Strip . . . Rod . . . Tubing . . . Wire . . . Castings . . . Welding Rods (Gas & Electric)
*Reg. U. S. Pat. Off.

	MONEL	"R" MONEL	"K" MONEL	"KR" MONEL	"S" MONEL	NICKEL	"Z" NICKEL	INCONEL
CORROSION RESISTANCE	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH
STRENGTH	GOOD	GOOD	HIGH	HIGH	GOOD	GOOD	HIGH	GOOD
TOUGHNESS	GOOD	GOOD	HIGH	GOOD	GOOD	HIGH	HIGH	HIGH
HARDNESS	GOOD	GOOD	GOOD	GOOD	HIGH	FAIR	HIGH	GOOD
MACHINABILITY	GOOD	HIGH	GOOD	HIGH	GOOD	GOOD	GOOD	GOOD
NON-GALLING	NO	NO	NO	NO	HIGH	NO	NO	NO
SPRING PROPERTIES	GOOD	NO	HIGH	NO	NO	GOOD	HIGH	HIGH
ELEC. CONDUCTIVITY	POOR	POOR	POOR	POOR	POOR	GOOD	GOOD	POOR
HEAT RESISTANCE	GOOD	GOOD	GOOD	GOOD	HIGH	GOOD	GOOD	HIGH
HEAT TREATABLE	NO	NO	YES	YES	YES	NO	YES	NO
NON MAGNETIC	NO	NO	YES	YES	YES	NO	NO	YES



It took thirty years...

...to design this boiler!

CAST STEEL HEADERS — permit tighter rolled tube joints.

SECTIONAL ONE PIECE BAFFLES —make a rugged, permanently tight baffle wall.

STAGGERED GROUP TUBE ARRANGEMENT — gives maximum heat absorption, producing higher efficiency.

SECTIONAL HEADER DESIGN — saves 30 to 60 days erection. Tubes rolled in headers at factory.

PERMANENTLY TIGHT BAFFLES —records show as much as 20 years without maintenance.

SINGLE CROSS DRUM—designed for fast, dry steaming.

IT TOOK OVER 30 YEARS and plenty of engineering courage to develop the modern Springfield boiler. In order to bring about higher efficiencies, faster steaming, greater responsiveness to load change, longer life of parts with less frequent and easier maintenance, Springfield engineers had to depart from previous concepts of design.

The fact that the first modern high ratings were accomplished with Springfield boilers is evidence of the success of this course.

For information on units to meet your requirements, write: SPRINGFIELD BOILER CO., 1953 E. Capitol Ave., Springfield, Ill.

SPRINGFIELD

STEAM GENERATING UNITS

SPRINGFIELD BOILERS

ANY SIZE ANY FUEL ANY PRESSURE

They even survive

Lowering completely assembled B&W boiler into car of 1000 kw. moLile power plant for assembly prior to shipment abroad. Boiler design is the popular B&W Integral-Furnace Boiler.

One of the 47 three-car, 1000-kw power trains built by General Electric and Westinghouse, and equipped with B&W boilers designed to burn peat, lignite, low-grade coal, and wood.

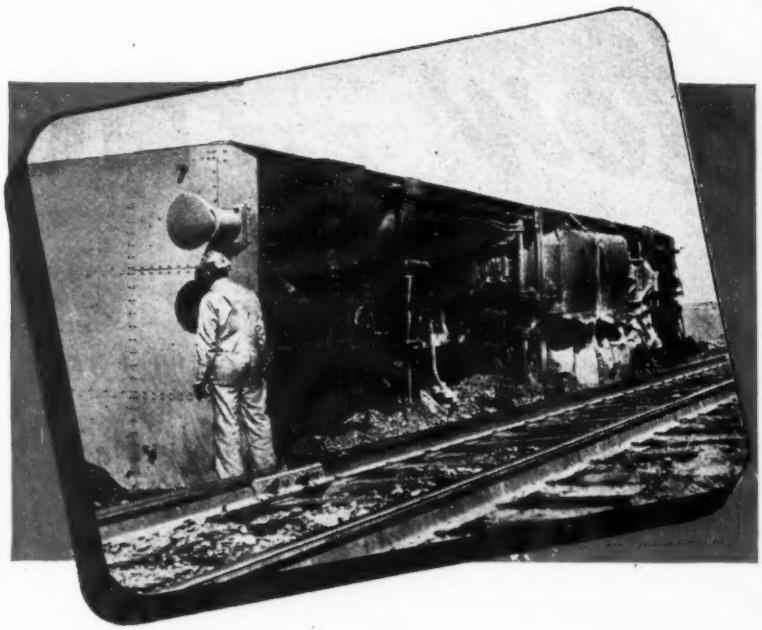
Furnace construction of B&W boilers used in mobile power plants. Neither sidewall tile, baffling, or front brickwork suffered cracks or other damage in derailed boiler car.

Firing end of power car boiler, showing locomotive-type overfeed stoker. Normal steam capacity of boilers is 16,000 lb. per hour at 420 psi. and 730 F.

B&W also designed and built the first and largest mobile power plants. They are 140,000 lb. per hour for six-car 10,000-kw. power trains for emergency use in American war production plants.

wrecks...

UNSCHEDULED "TEST" PROVES STURDINESS OF B&W BOILERS



AN ill wind, in the form of a railroad accident, recently produced spectacular evidence of B&W boiler sturdiness, in a "test" as convincing as any ever devised by our own test engineers.

En route to Russia coupled in a freight train, the boiler car of a 1000-kw mobile power plant was derailed, dragged for a considerable distance, and turned on its side clear of the tracks.

Instead of being severely damaged as might be expected, when returned to the plant for inspection the boiler withstood the hydrostatic test pressure of 625 psi without a leak. The furnace absorbed the jolt without damage. Neither sidewall tile, baffling, or front wall brickwork suffered a crack. Damage was confined to ash-pans and pipe connections under the car. The boiler survived its fall, stood up to every test—was soon on its way to its job of supplying steam power to devastated areas abroad!

At your disposal, on any problem involving steam generation or heat transfer equipment are the B&W engineers and facilities whose products withstand such tests—the same organization that, for over 60 years, has led the trend in boiler design and workmanship: B&W designed and developed the first successful water-tube boiler; pioneered in the welding of boiler drums and in X-ray inspection of welds; has led in the development of high-pressure boilers, in conducting research in the creep of steel, and in developing improvements in equipment for producing clean, dry steam. B&W introduced the integral water-cooled furnace boiler, the Radiant, and Open-Pass boilers, and has pioneered in many other developments that have set today's boiler standards.

B&W

Water-Tube Boilers, for Stationary Power Plants, for Marine Service . . . Water-Cooled Furnaces . . . Superheaters . . . Economizers . . . Air Heaters . . . Pulverized-Coal Equipment . . . Chain-Grate Stokers . . . Oil, Gas and Multifuel Burners . . . Seamless and Welded Tubes and Pipe . . . Refractories . . . Process Equipment.

BABCOCK & WILCOX

THE BABCOCK & WILCOX CO.
85 LIBERTY STREET, NEW YORK 6, N.Y.

G-28IT

Now UP TO 2000 hp!

STANDARD 2000-HP TRI CLAD MOTORS NOW AVAILABLE

THEY GIVE EXTRA PROTECTION 3 ways

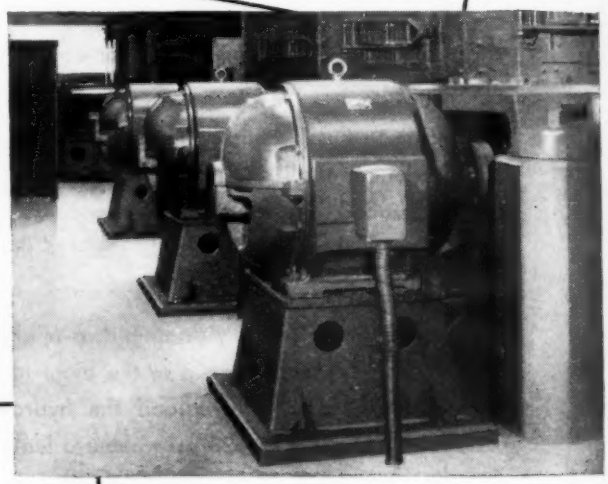
1 Extra protection from physical damage—Cast-iron construction. Upper portion completely enclosed. Streamline, cast-iron end shields. Corrosion-resisting finish.

2 Extra protection from electrical breakdown—Windings of Formex* wire, strongly bonded with oil- and moisture-resistant synthetic resins, stand up under abrasion or "heat-shock."

3 Extra protection from operating wear and tear—Sleeve or ball bearings, in dust-tight housings. Sleeve-bearing design is a further refinement of well-proved Tri-Clad bearing proportions, with cast-in "air seal" to further insure oil tightness of the housing.

The triple-protected construction that has made General Electric's Tri-Clad motor so popular in the small and intermediate sizes has now been extended to motors of 2000-hp capacity. On your *big* drives, these new Tri-Clad motors will meet severe conditions with greater assurance than ever of dependable service and long life.

The Tri-Clad motor, in its wide range of types and sizes, is industry's most popular integral-hp motor. Chances are there's a standard Tri-Clad to meet your requirements "on the nose." For information on G.E.'s complete line of Tri-Clad motors, ask for Bulletin GEA-3580. *General Electric Company, Schenectady 5, N. Y.*



Three of the new, large Tri-Clad motors, each rated 200 hp, 1200 rpm, driving coal pulverizers in a Southern steam-electric plant

*Trade-mark reg. U.S. Pat. Off.

HERE'S TODAY'S WIDER RANGE OF STANDARD SIZES

TRI CLAD Type K	—1 hp to 2000 hp at 1800 rpm
TRI CLAD Type KG (High starting torque, low starting current)	—5 hp to 200 hp at 1800 rpm
TRI CLAD Type KR (High starting torque, high slip)	—Available to 100 hp in speeds required for high-slip, flywheel drive (punch press, etc.)

Buy all the BONDS you can—*and keep all you buy*

GENERAL ELECTRIC

DOUBLE PLANT CAPACITY AT FANNY
(Reprinted from "ENERGY", August, 1943)
Schematic Drawing showing part of system at Fanny Farmer candy plant at Cambridge. Mass. showing installation of Cochrane C-B System.
A New Method of Draining Condensate from process equipment . . . returning it to the boiler under high pressure . . . with maximum heat economy.
PUBLICATION No. 3750
COCHRANE
C-B
SYSTEM
For increasing heat transfer rates in Steam Process Equipment . . .
CONDENSATE RETURNED TO BOILERS AT HIGH PRESSURE AND HIGH TEMPERATURE
COCHRANE CORPORATION · PHILADELPHIA 32, PA.

Important Information

for anyone concerned with the use of steam in processing operations of any kind. A means of increasing production, improving quality and saving fuel in percentages that are almost unbelievable. A copy of this publication will be mailed upon request. Use coupon.

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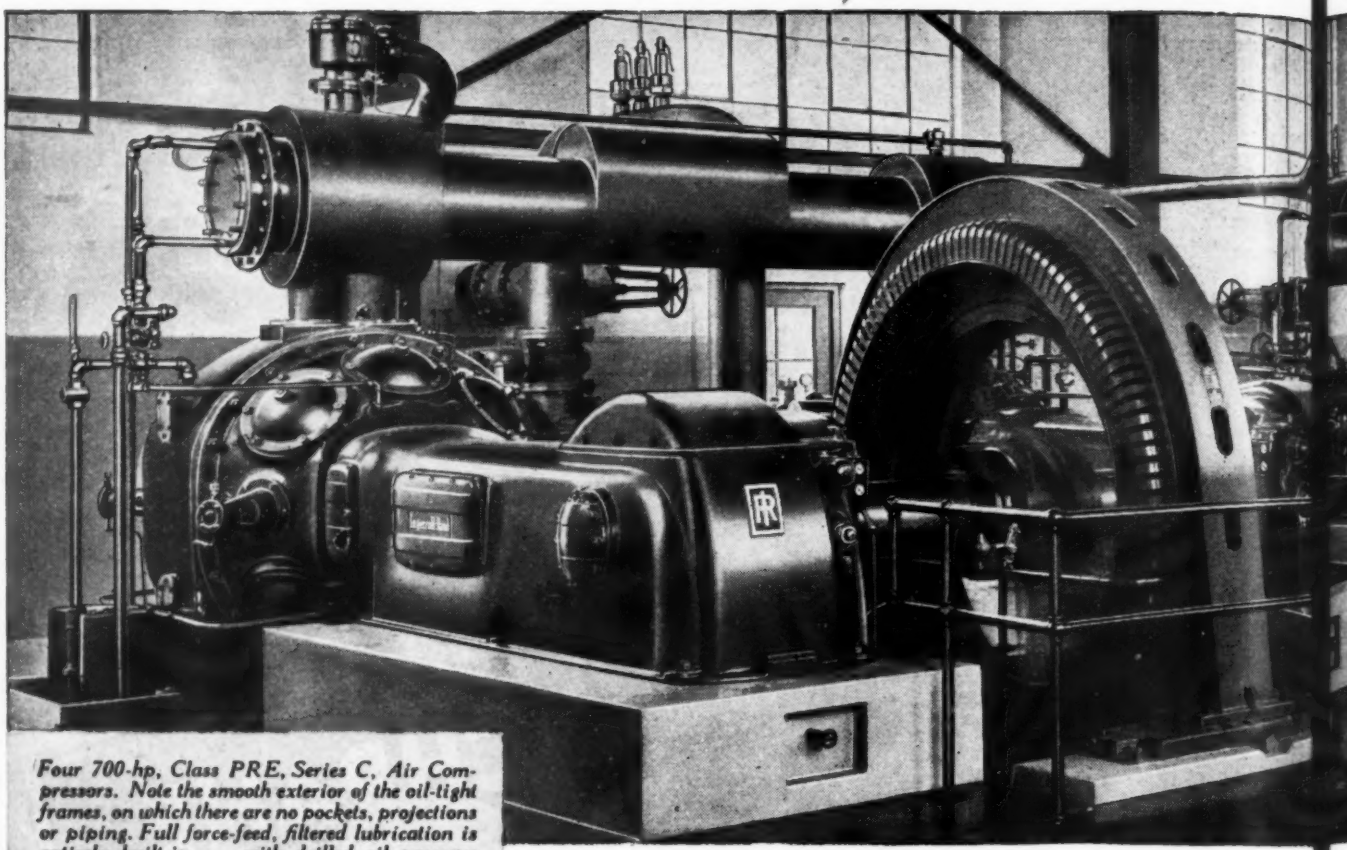
3106 N. 17th Street, Philadelphia 32, Pa.
Please send me a copy of your Publication No. 3750.

Name _____

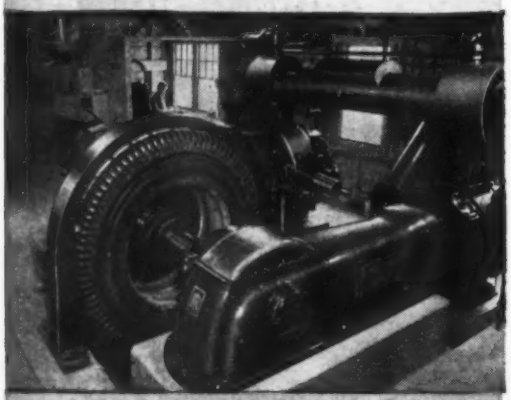
Title _____

Company _____

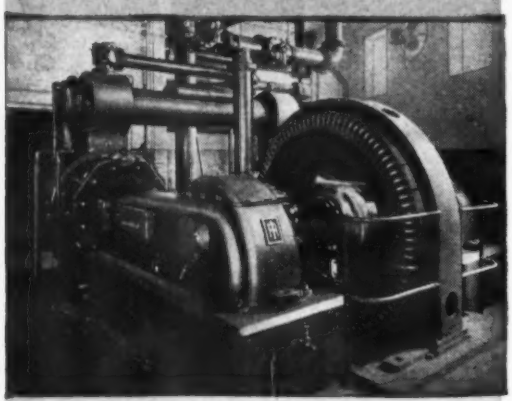
Address _____ City _____ State _____



Four 700-hp, Class PRE, Series C, Air Compressors. Note the smooth exterior of the oil-tight frames, on which there are no pockets, projections or piping. Full force-feed, filtered lubrication is entirely built-in . . . with drilled oil passages throughout. The crankcase, which need not be opened for adjustments, stays clean. Gauges on each frame indicate main-bearing oil pressure and temperature.



A 350-hp, Class PRE two-stage Air Compressor supplying air for operating rock drills in a mine.



A 21"-stroke, Class PRE, two-stage Air Compressor in a steel plant.

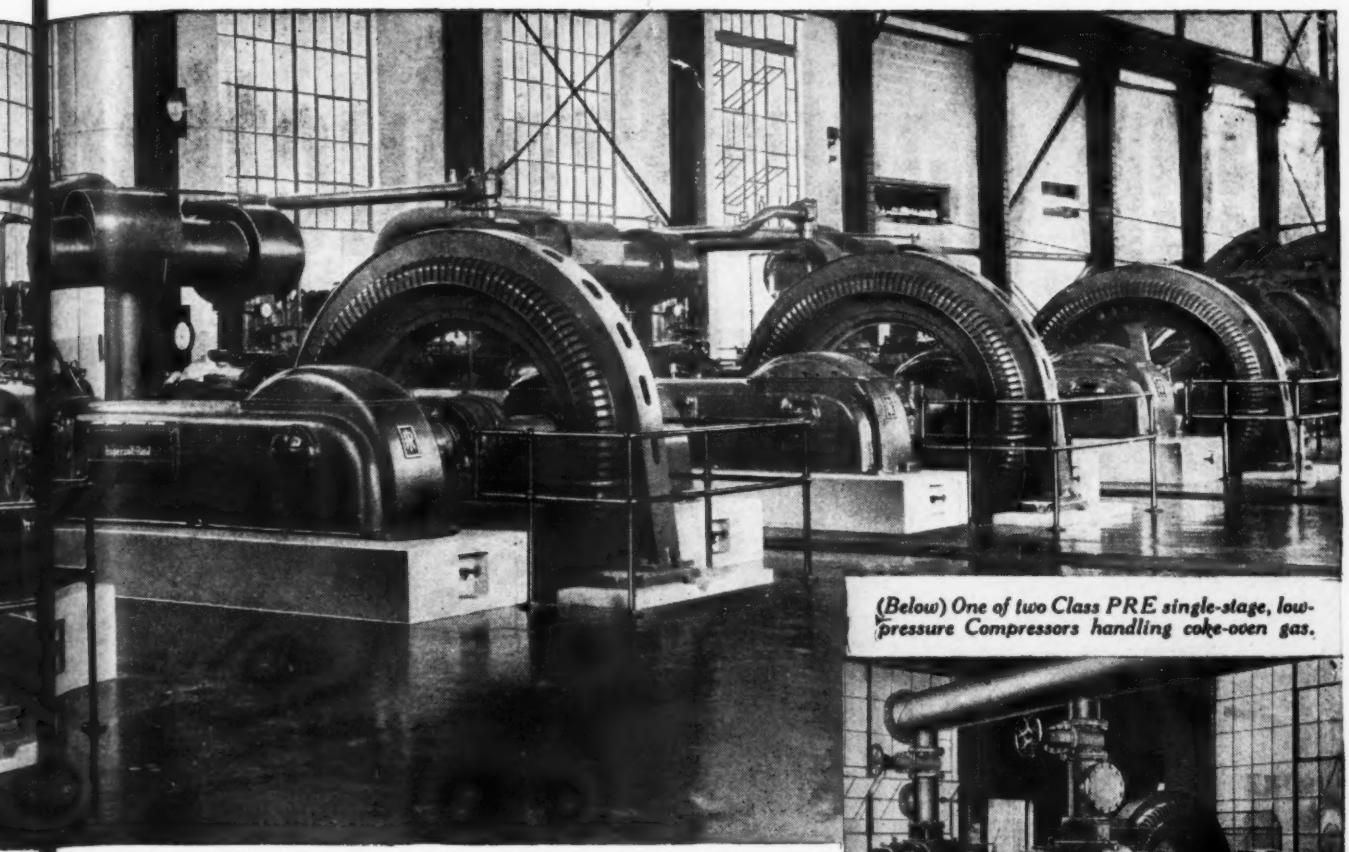
. . We hope you were . . Compressors

Perhaps your company was one of those permitted by WPB to purchase a new Series C, Class PRE, during the hectic days when compressors were so critical to the war effort. If so, you now have a machine that's years ahead of conventional design. You will be proud of it for years to come . . . and you will save a lot of money in upkeep and power cost.

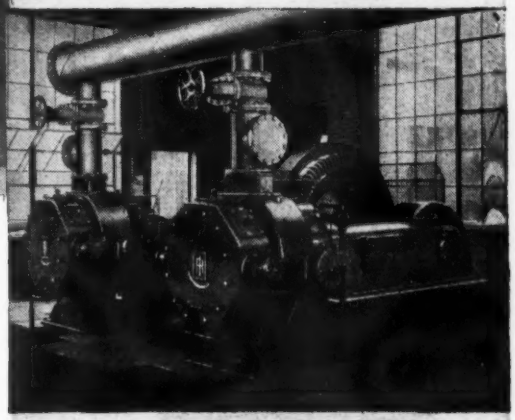
This compressor is new . . . yet hundreds of them are already in service, and have helped to make huge increases in the production of explosives, steel, rubber, ships, airplanes, and tanks—in fact, every kind of war materiel.

Its new frame and running gear represent a com-

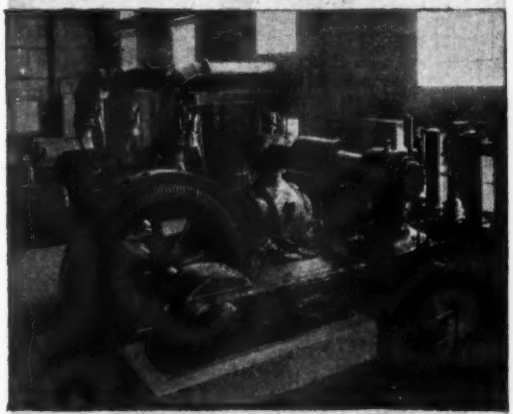
COMPRESSORS • CONDENSERS • ROCK DRILLS • AIR TOOL



(Below) One of two Class PRE single-stage, low-pressure Compressors handling coke-oven gas.



(Below) A 3800-cfm, Class PRE Compressor furnishing air at 100-lb pressure, and three I-R Turbo-Blowers furnishing lower-pressure air for a copper mining company.



ucky enough to get

ike these!

plete change in construction, radically different from previous designs. Its features provide greater reliability and ease of maintenance . . . making it a machine that comes even closer to the "ideal" compressor that operators like to dream about.

If you are the owner of a new PRE, we need say no more... but if you are not, consult one of our Service Engineers who will gladly explain the many advantages of this heavy-duty electric-driven compressor.

Ingersoll-Rand

11 BROADWAY, NEW YORK 4, N. Y. 1-535

REMEMBER, all PRE Compressors are equipped with full, 5-step Clearance Control. This is the method of regulation that we originated, patented, and applied in 1910. It has been the standard for 34 years. We continue to use it because it is still the best method of regulating the output of large electric-driven compressors.

URBO BLOWERS • CENTRIFUGAL PUMPS • OIL & GAS ENGINES

Keep down Production

with Tight Valves ON AIR, STEAM, AND WATER LINES

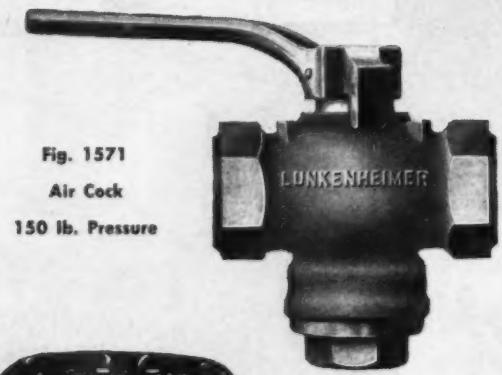


Fig. 1571
Air Cock
150 lb. Pressure

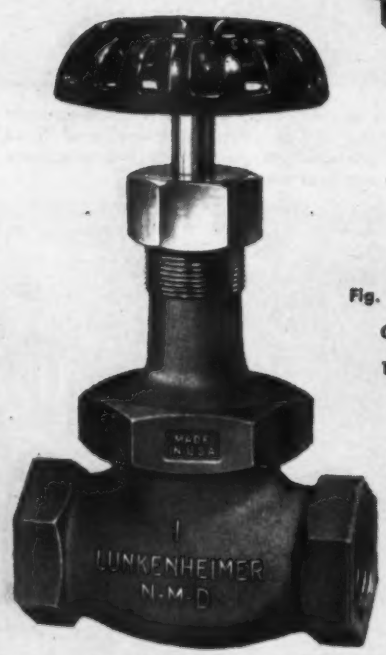


Fig. 123, "N-M-D"
Globe Valve
150 lb. S. P.

Leaky valves, permitting the escape of steam, air, or water, are wasteful in themselves—doubly wasteful in their effect on production costs and operating efficiency.

Inadequate, hand-method lubrication is another cost booster... increasing expense of machinery repair, of lubricant, of inspection time.

And—ultimately—*both* leaky valves and inefficient lubrication mean a *waste of fuel.*

Lunkenheimer Valves and Air Cocks have a rugged durability and simplicity of design that makes them *stay tight* with the very minimum of maintenance . . .

LUNKENHEIMER

Costs...

Efficient Lubrication OF BEARINGS

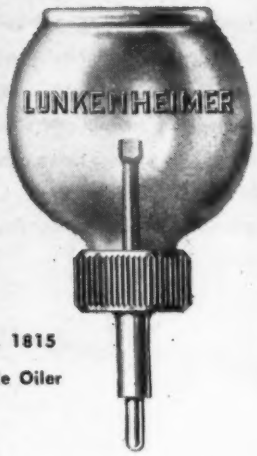


Fig. 1815
Bottle Oiler

Fig. 1834
"Alvor" Constant Level
Oil Control

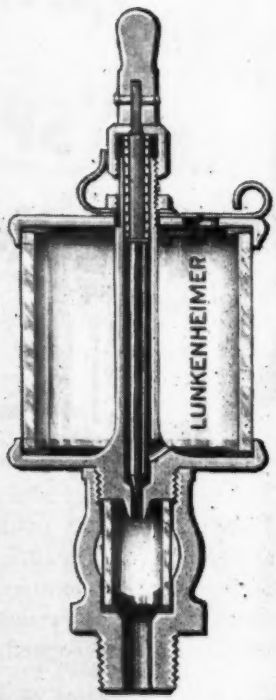
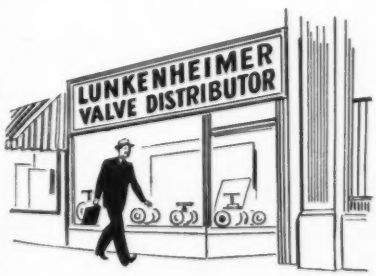


Fig. 1300
"Sentinel" Oil Cup
with Sight Feed

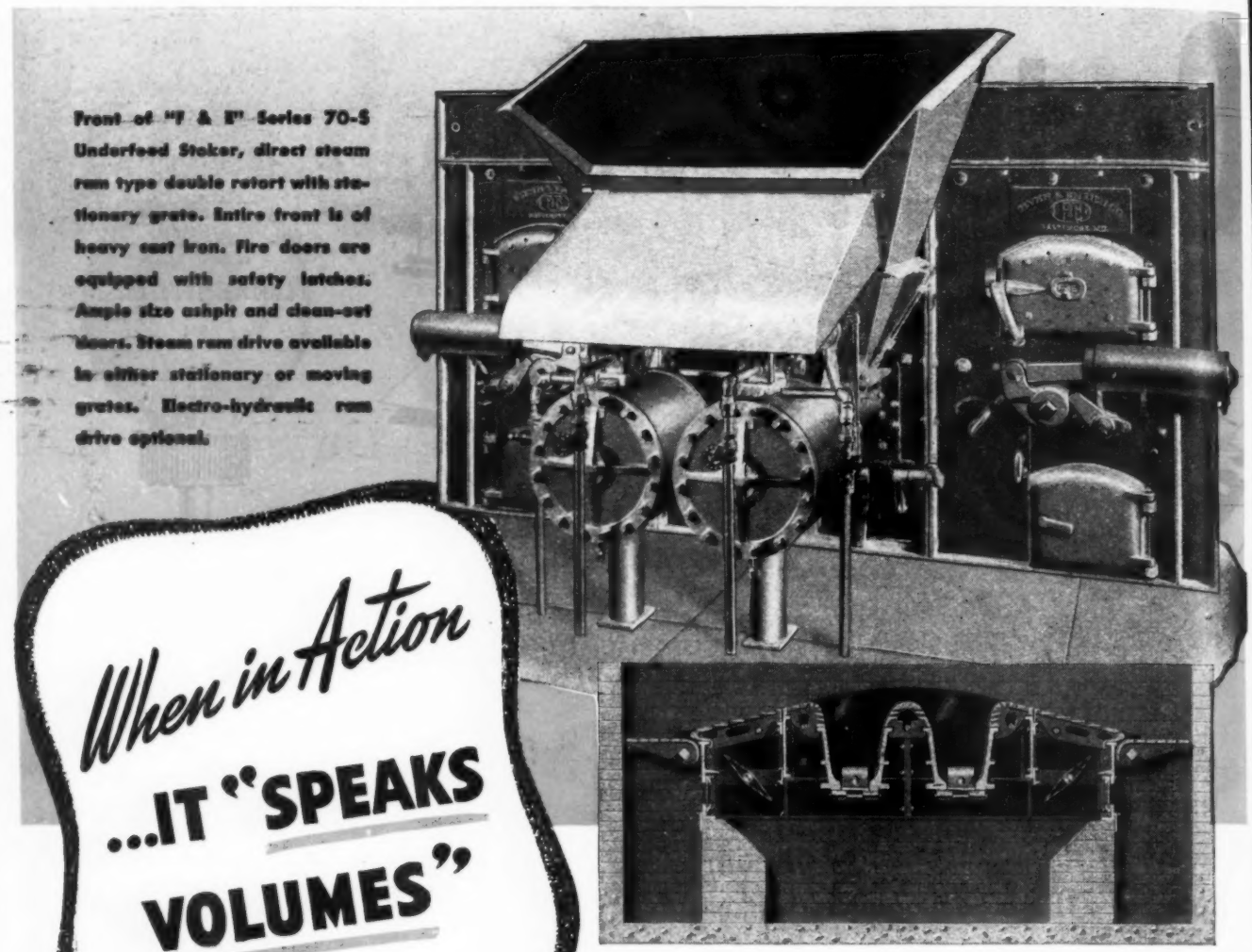
Lunkenheimer Automatic Oilers feed the right amount of oil, in the right way, at the right time, to the right place . . . These and other Lunkenheimer products are famous for their outstanding performance record.

The Lunkenheimer Co., Cincinnati 14, Ohio, U.S.A. (Branch Offices: New York 13, Chicago 6, Boston 10, Philadelphia 7. Export Department: 318-322 Hudson St., New York 13, N. Y.)



A Lunkenheimer Distributor is located near you, fully equipped to assist with your maintenance problems. Call on him.

VALVES & LUBRICATING DEVICES



Front of "F & E" Series 70-S Underfeed Stoker, direct steam ram type double retort with stationary grate. Entire front is of heavy cast iron. Fire doors are equipped with safety latches. Ample size ashpit and clean-out doors. Steam ram drive available in either stationary or moving grates. Electro-hydraulic ram drive optional.

When in Action ...IT "SPEAKS VOLUMES"

Cross-section of double retort stationary grate stoker, equipped with "F & E" air zoned windbox. Close spacing of the bearing bars gives rigid and durable construction. All "F & E" tuyeres and grates are made of heat-resisting metals and designed to deliver air to fuel bed in correct proportions and pressures.

Teamed up with boilers called upon to produce 25,000 to 40,000 pounds of steam per hour, the "F & E" Series 70-S, double retort Underfeed Stoker, with built-in reserve ruggedness, settles down to a tireless, steady pace, delivering steam-power in uninterrupted, dependable volume.

The steam drive of "F & E" 70-S, simple, direct and economical, operates the ram by steam direct from boiler, eliminating all intermediate driving equipment. The "F & E" patented automatic Interval Timer Governor makes possible *that full stroke, full speed ram action* at any coal feeding rate, a proved essential to efficient fuel burning.

Only in "F & E" Stokers are found the combination of six engineered features that dove-tail into an accurate firing mechanism, resulting in a concentrated self-contained assembly.

Check with your consulting engineer or local "F & E" Representative on "F & E" Series 70-S Stoker applications with industrial boilers in prominent plants and large buildings.

FLYNN & EMRICH CO.

Established 1842

HOLLIDAY & SARATOGA STREETS, BALTIMORE 2, MARYLAND

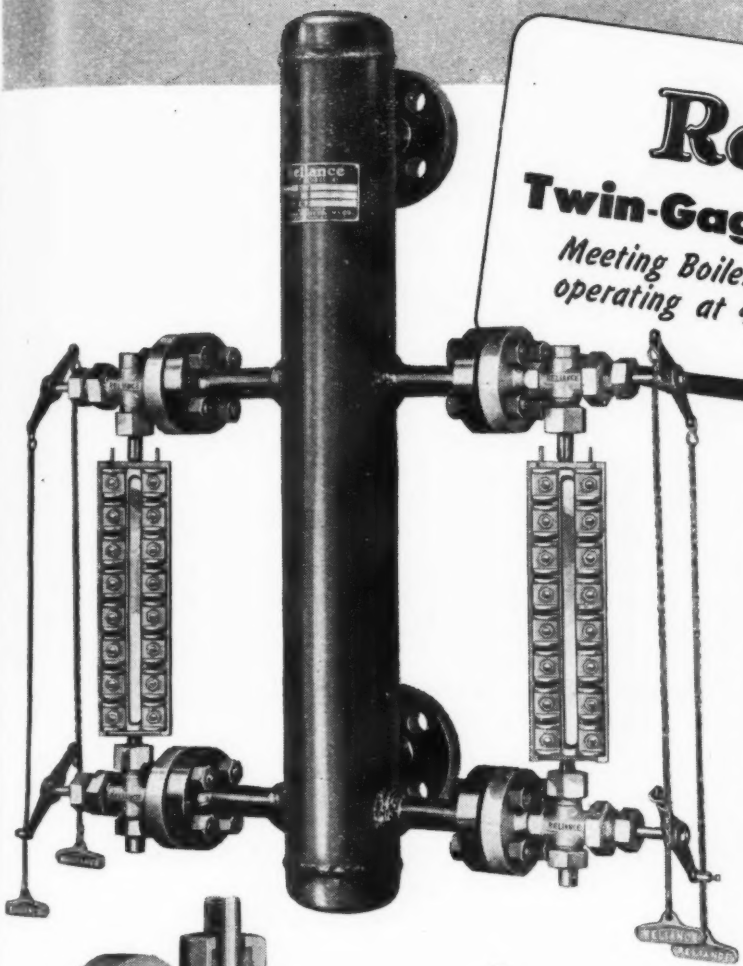
Representatives in Principal Cities

F&E Underfeed Stokers

HYDRAULIC DRIVE AND STEAM DRIVE FOR BOILERS PRODUCING 10,000 TO 40,000 LBS. OF STEAM PER HOUR

Here's your simplest and most convenient method of mounting two boiler water gages at the same elevation . . .

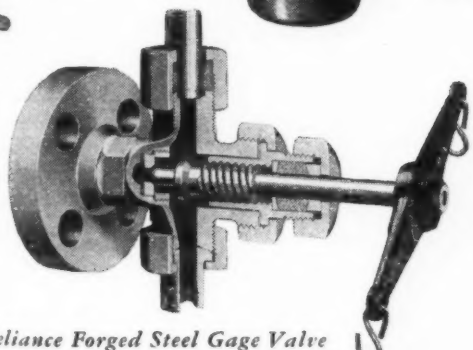
Reliance
Twin-Gage Water Columns
Meeting Boiler Code Requirements on units operating at 400 pound W.S.P. or above



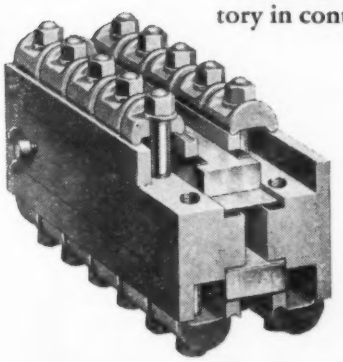
GOOD PRACTICE in applying the code requirements for two water gages on high pressure boilers dictates a *water column assembly* for flexibility of placement, ease of providing mechanical support, greater stability of water level indication, provision for high and low alarm signal if desired, and over-all convenience and safety of operation. One approved method is to employ two conventional water columns—on opposite drum ends—each having a single water gage. Another method is the use of twin gages on a single column, with flanges (or welding necks) at 180° separation, as in the illustration, or at various angles, bringing flanges as close as 90°.

Reliance all-welded Water Columns with twin gages have been available since this requirement went into effect. Several installations of many months service have proved completely satisfactory in continuous operation. You can get complete Reliance Water Column and Gage equipment for your high pressure boilers, in standard or custom-made models.

• Write Reliance for complete information, or check with your consulting engineer.



● *Reliance Forged Steel Gage Valve No. SG460 with stainless stems and renewable seats. Also other valves for pressures to 2000 lbs.*



● *Reliance Mica-Protected Flat Glass Water Gage Insert — an efficient, shatterproof indicator built for clear readability and safety on high pressures.*

BOILER SAFETY DEVICES since 1884

Reliance

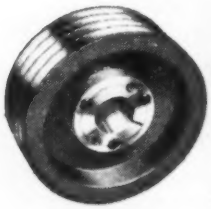
THE RELIANCE GAUGE COLUMN CO. • 5902 CARNEGIE AVENUE • CLEVELAND 3, OHIO

New

TAPER-LOCK

Sheave

PATENT APPLIED FOR



An entirely new type of taper bore sheave! No flanges . . no collars . . no excess weight. Breaks all speed records in mounting and demounting . . Saves time and temper . . And it's available in *ALL* stock sizes!

DODGE MANUFACTURING CORPORATION
MISHAWAKA INDIANA

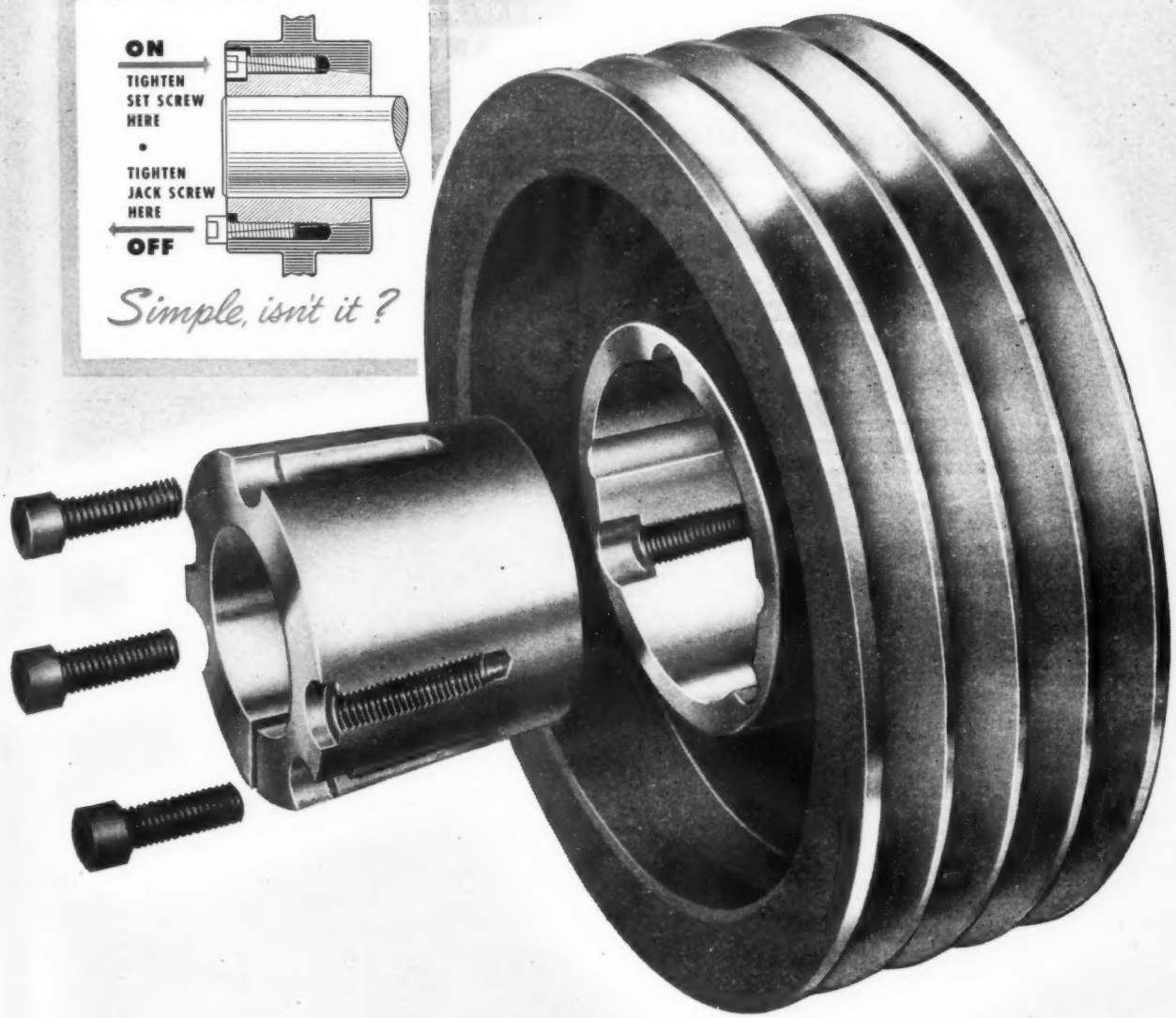
DODGE
MISHAWAKA

TRANSMISSIONEERED MEANS

- Here is the simplest, surest mechanism ever devised for holding wheels to shafts! No flange. No collar. No protruding parts.
- The Taperlock Sheave mounts as a complete unit. Slip it on, line it up and tighten *while sighting*. It's in place on the first try!
- The bushing is wedged into the sheave by means of set screws—with a firmness equivalent to a shrunk-on fit—whether the shaft is standard or normally undersize.
- The Taperlock runs *true*. The bushing extends the entire length of the hub; it provides a *full* bearing surface.
- Close mountings are made possible. No flange nor collar nor other device is required at either end of the sheave hub.
- The Taperlock "unlocks" with less effort than any other sheave—due to its special taper.
- Taperlock Sheaves will be available in all stock sizes. For details call your local Dodge Transmissioneer. You'll find his name listed under "Power Transmission Equipment" in your classified phone book.. Or write Dodge, Mishawaka.

SIGN OF THE DODGE TRANSMISSIONEER

There are 257 Dodge factory graduate Transmissioneers, located in principal cities, to show you NEW and BETTER ways of transmitting power.



ADVANCED DESIGN IN POWER DRIVES

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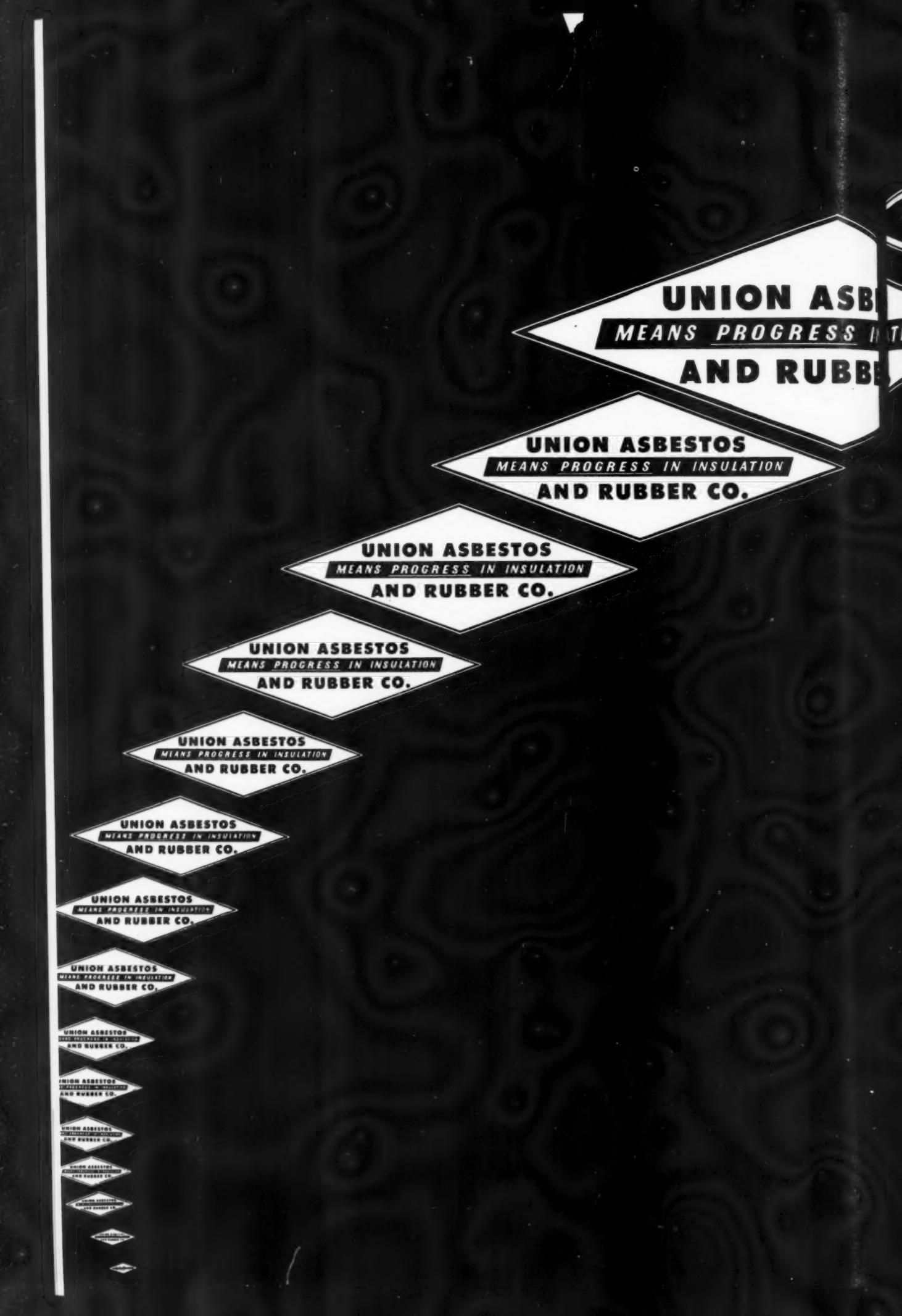
UNION ASB
MEANS PROGRESS
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"MEANS PROGRESS IN INSULATION"...

Much that is new in insulation (both manufacturing and application) has been introduced and is being developed by Union Asbestos. This is no idle boast, for such advancements as simplicity of application, higher efficiency and reusability as you will find in Unibestos, Insutube, Insutape, Unibestos Felt and other heat insulations has been developed by Union Asbestos specialists in Industrial insulations with a background of close collaboration with the nation's mechanical engineers. Accordingly, Union Asbestos engineers are keeping abreast of new developments in Plant Equipment—and Union Asbestos research is developing insulations that keep pace with the insulating requirements of this new equipment.

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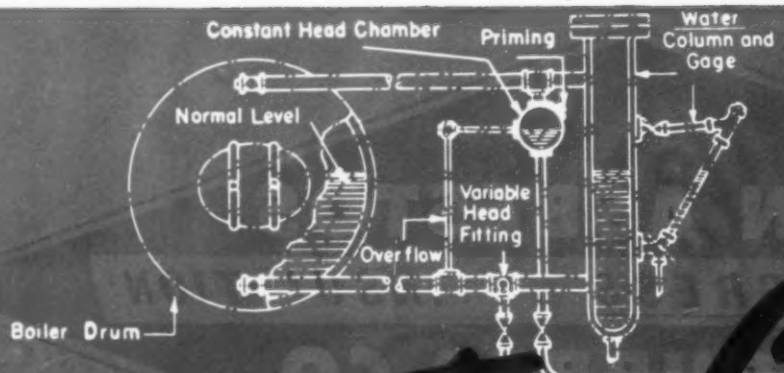

Positive Check ON BOILER WATER LEVELS

RIGHT BEFORE YOUR EYES

No more guessing about boiler water levels! Now you can have a constant, positive check right before your eyes . . . on a brilliantly-lighted scale, on the instrument panel or at any other convenient place.

The Yarway Remote Liquid Level Indicator shows water level beyond the range of the overhead gage, and always indicates high or low—even when full or empty gages look the same.

It's accurate because it's operated by the boiler water itself . . . by the pressure differential between a constant head of water and the varying head in the boiler drum. Indicating mechanism is never under pressure. Action is instant, constant, frictionless. *There are no stuffing boxes.* Mechanism is perfectly balanced on jewelled bearings outside the pressure chamber.

Yarway Remote Liquid Level Indicators are suitable for all pressures up to 1500 psi.

Already more than 2,000 have been bought. Ideal not only for boiler water level indication, but also to indicate superheater pressure differentials, feed-water-heater levels, and other liquid levels. Write for Bulletin WG-1820.

YARNALL-WARING COMPANY
100 Mermaid Ave., Philadelphia 18, Pa.

Ask about the new 30-minute color and sound motion picture, with Lowell Thomas speaking — available for group showings.

Made for Flush Panel Mounting —or Wall Mounting (as shown).

YARWAY REMOTE LIQUID LEVEL INDICATOR

Tougher tubes take the air

Tube failure occurred after 6 months' service in the inlet sections of main and auxiliary condensers of a turbine-driven Pacific Coast ship. Non-metallic inserts had been installed when severe inlet corrosion was observed. This early difficulty was followed by failure. Scovill was called in.

Laboratory examination disclosed a light brown protective film in irregular bands inside the tubes. Elsewhere severe pitting and thinning of the tube wall was found. The pits, irregular in shape, showed elongated tails in the direction of flow.

IRREGULAR ATTACK POINTS TO CURE

Searching further, the Scovill men found evidences of mechanical abrasion and erosion of the protective coating attributable to high velocity of the circulating medium containing entrained air. Non-metallic inserts had protected the tubes from inlet end erosion, but erosion-corrosion was found to be general throughout the length of the tubes.

The units were retubed with 70/30 Cupro-Nickel and no further failures were reported. Erosion-corrosion can often be minimized by preventing air leakage in circulating water and by eliminating turbulence and low pressure areas where dissolved gases can separate.

OTHER SCOVILL SERVICES

In addition to *Service in Men*, which includes assistance with installation problems and specialized advice on tube specifications, Scovill offers two additional services.

Service in Metals undertakes the selection of alloys and the study of specific problems both in the field and in the laboratory.

Service in Manuals offers valuable literature on condenser and heat exchanger tubes. Write for your copy of our Condenser Tube Booklet. Address Scovill Manufacturing Company, 13 Mill Street, Waterbury 91, Conn.

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MANUFACTURING COMPANY
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CONDENSER TUBES
ONE PRODUCT . . . THREE SERVICES
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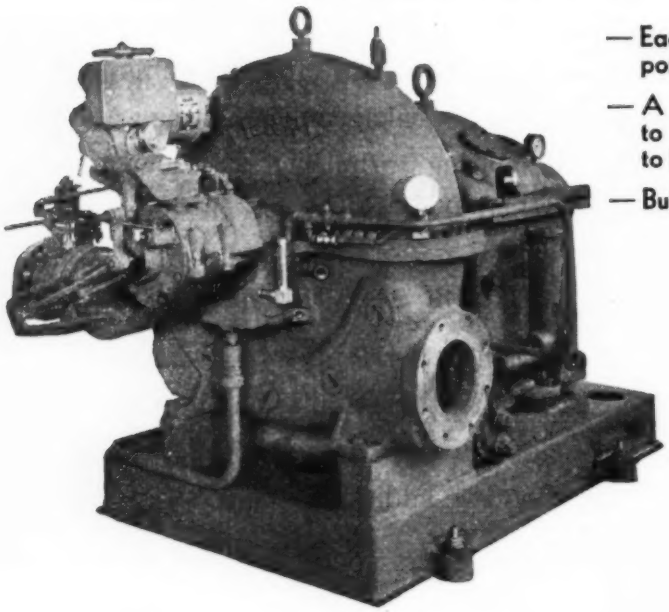
The TERRY

—IS BUILT IN A WIDE RANGE OF SIZES FOR ALL MECHANICAL DRIVE APPLICATIONS



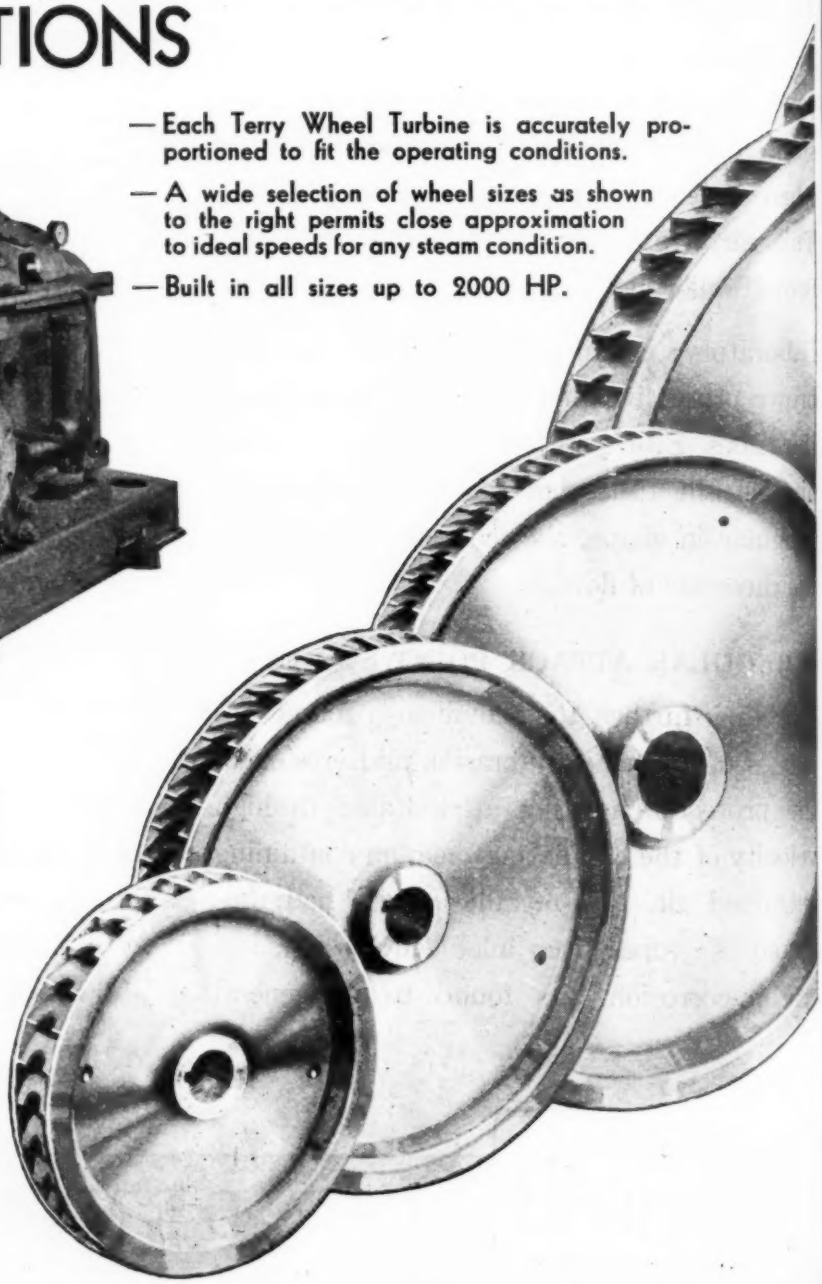
— Each Terry Wheel Turbine is accurately proportioned to fit the operating conditions.

— A wide selection of wheel sizes as shown to the right permits close approximation to ideal speeds for any steam condition.

— Built in all sizes up to 2000 HP.

ABOVE:

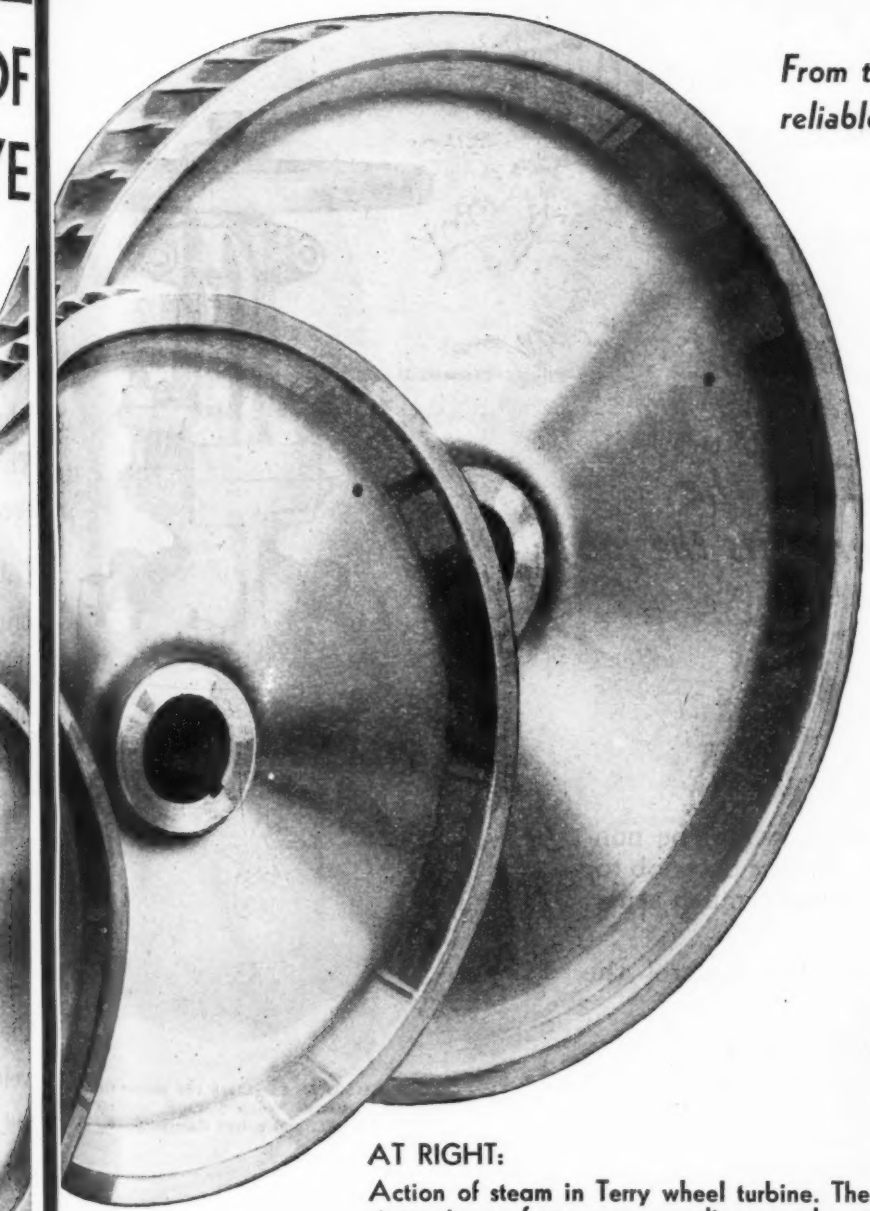
Typical Terry Solid Wheel Turbo-Gear Unit. Rated 160 HP at 4000 to 1720 RPM with steam conditions of 400 lbs., 750°F.TT, 30 lbs. Used for Blower Drive.



FOR FULL DETAILS ASK FOR BULLETIN S-116

THE TERRY STEAM TURBINE CO.

Wheel Turbine



From the smallest to the largest these reliable turbines have—

- ★ Indestructible one piece wheel.
- ★ Large radial and axial clearances.
- ★ Double rim protected blading.
- ★ Individual nozzle control.
- ★ Dependable and durable governor.
- ★ Heavy dust-proof bearing and governor housing.
- ★ Independent overspeed trip with separate valve.
- ★ Sturdy casing design.
- ★ Strong and easily inspected steam strainer.
- ★ Truly accessible construction, which makes inspection of the interior parts a simple matter.

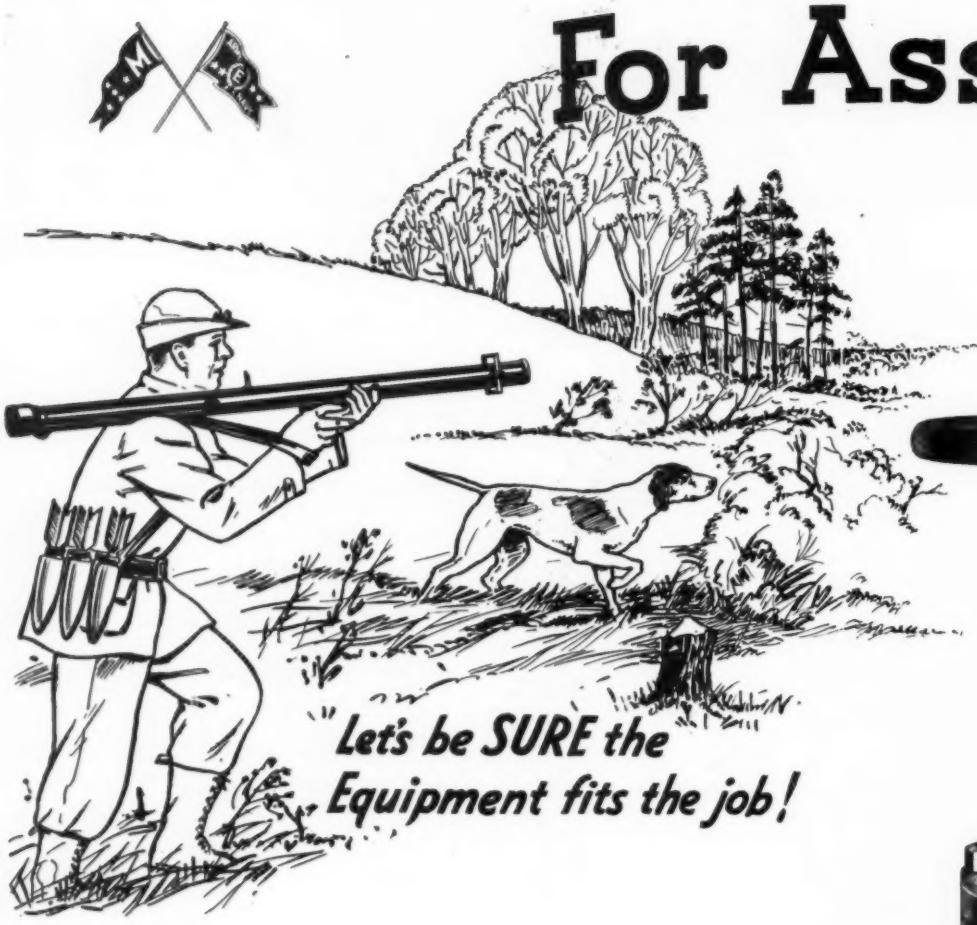
AT RIGHT:

Action of steam in Terry wheel turbine. The steam issues from an expanding nozzle at high velocity and enters the side of the wheel bucket in which its direction is reversed 180°. As this single reversal uses but a portion of the available energy, the steam is caught in a stationary reversing chamber and returned again to the wheel. This process is repeated several times until practically all of the useful energy has been utilized.

T-1159

TERRY SQUARE - HARTFORD, CONN.

For Assured



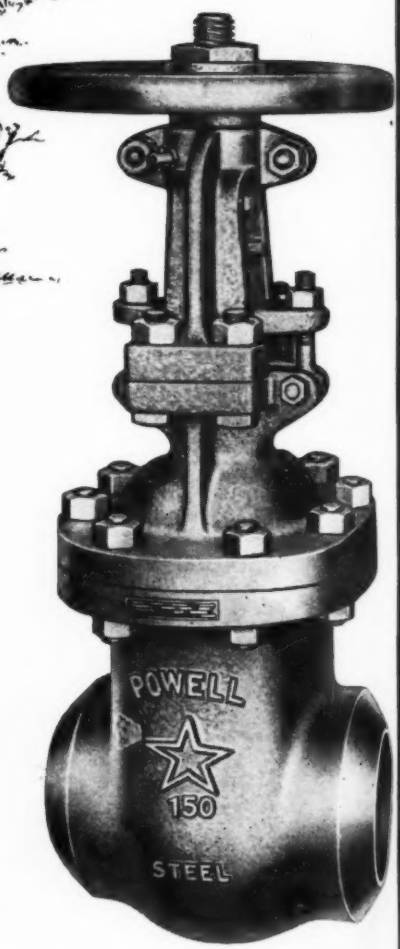


Fig. 1503 W. E.—Class 150 pound Cast Steel Gate Valve. Welding Ends, outside screw rising stem and bolted flanged yoke.

Shooting quail with a bazooka would be nonsensical. But trying to make a valve do a job for which it is not suited doesn't make much sense, either.

For assured performance in flow control the valve *must fit the job.*

That's why Powell maintains a staff of valve engineers who are always at your service for consultation and advice. And if you have any individual flow control problems, Powell Engineering is ready to design the correct valves to meet them.

The Wm. Powell Co., Cincinnati 22, Ohio

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Valve Performance

Consult POWELL ENGINEERING *First*

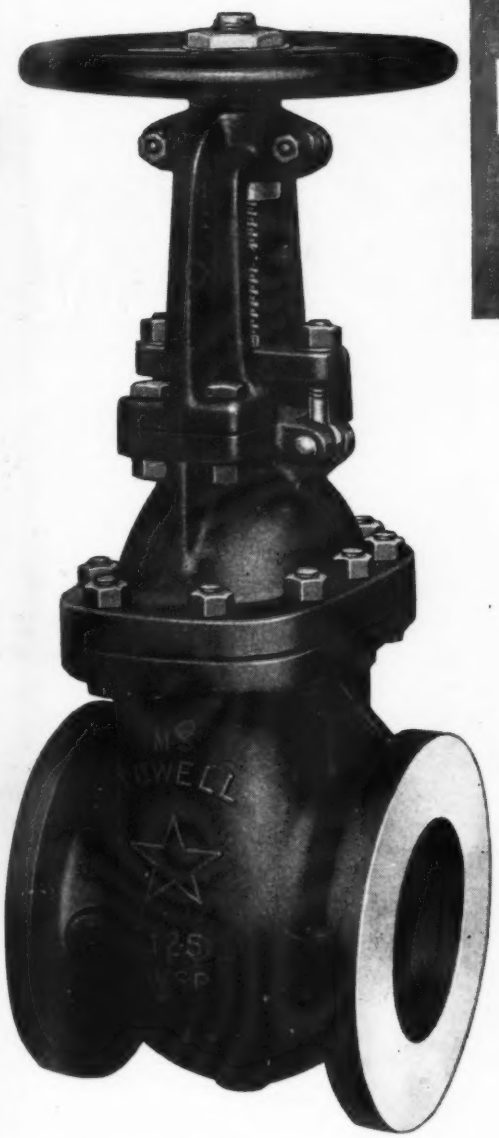


Fig. 1793—Iron Body Bronze Mounted Gate Valve for 125 pounds W. S. P. Flanged ends, outside screw rising stem, bolted flanged yoke, bronze seat rings and taper wedge solid disc. Also available with taper wedge double disc—Fig. 1444.

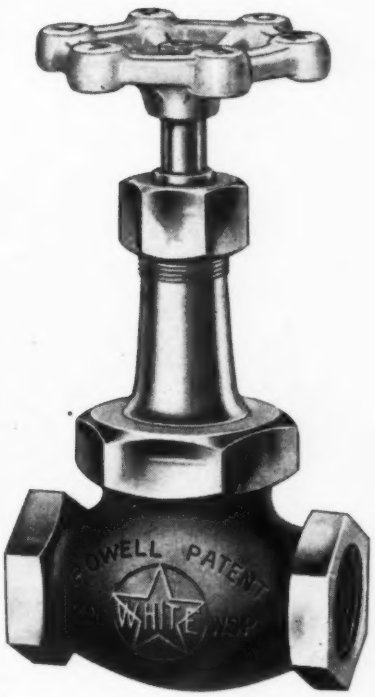


Fig. 1708—Bronze Globe Valve for 200 pounds W. S. P. Screwed ends, union bonnet, renewable seat and re-grindable, renewable, wear-resisting "Powellium" nickel-bronze semi-cone, plug type disc.

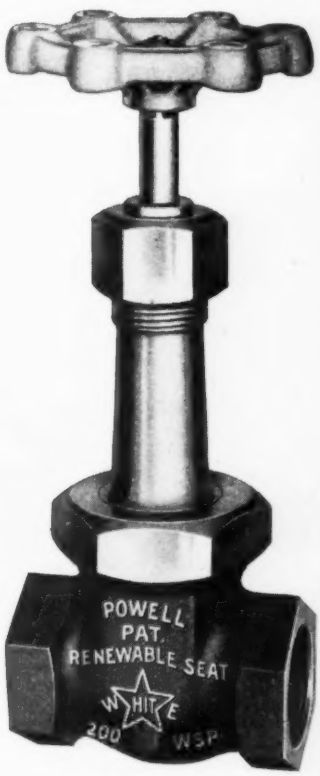
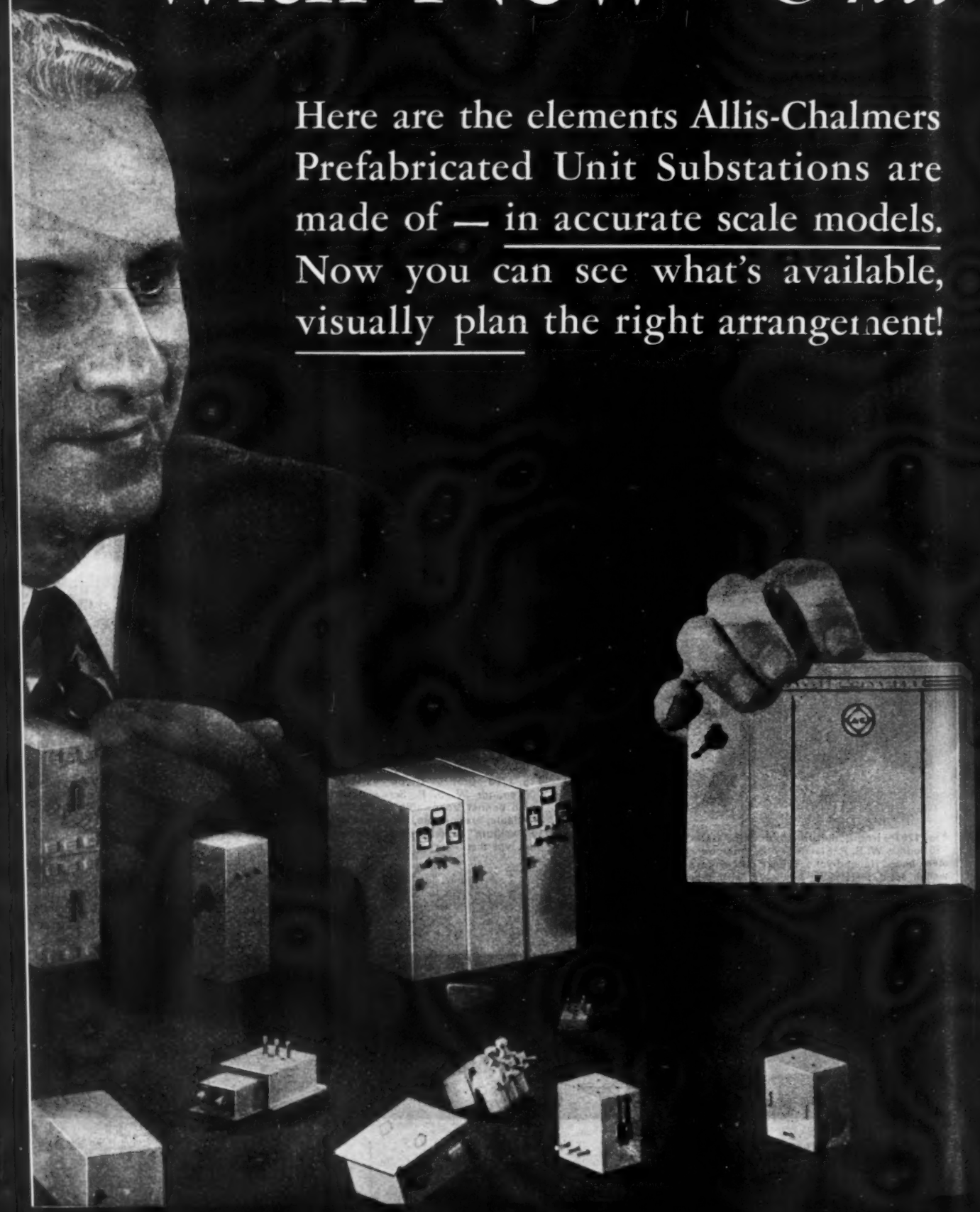


Fig. 1375—Bronze Gate Valve for 200 pounds W. S. P. Screwed ends, inside screw rising stem, union bonnet, renewable wear-resisting bronze seat rings and taper wedge solid or double disc

VALVES

See Your Unit Sub with New "*Unit*

Here are the elements Allis-Chalmers Prefabricated Unit Substations are made of — in accurate scale models. Now you can see what's available, visually plan the right arrangement!



p Ideas Worked out

t Sub Builder" Set!

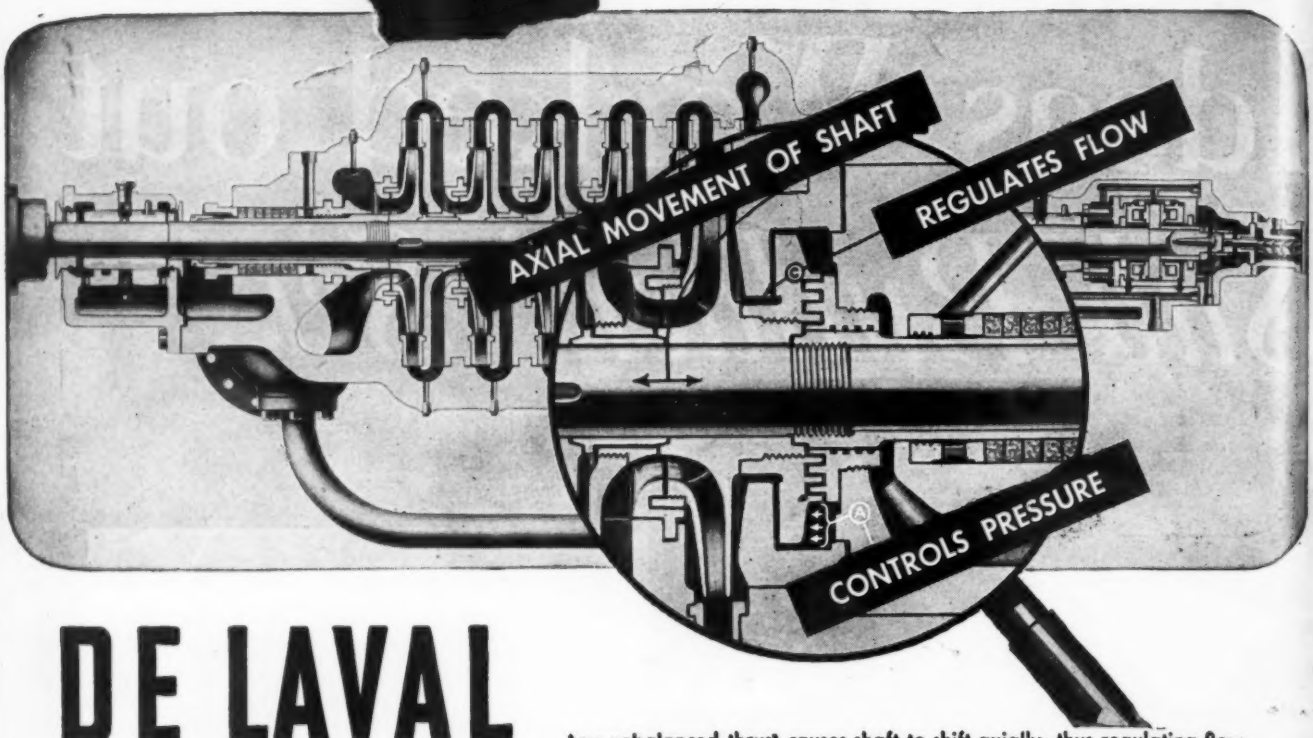
SEE WHAT'S AVAILABLE, experiment with various arrangements, make comparisons, build solutions. That's the simple, idea-stimulating procedure you follow when you use accurate new scale models of Allis-Chalmers Prefabricated Unit Substation elements to help work out your power distribution problems.

Visual planning of unit sub requirements is quick, accurate. At a glance you see what space the *right* arrangement will occupy . . . how it will look installed in your own plant. An even clearer picture will result if models are built up on a floor plan of your plant drawn to the same scale . . . ½ in. to 1 ft.

"Unit Sub Builder" Set will be shown by a field engineer from your nearby A-C office upon request. No obligation, of course. ALLIS-CHALMERS, MILWAUKEE 1, WISCONSIN.

ALLIS-CHALMERS

A 1738



DE LAVAL

BALANCING ARRANGEMENT *Automatically* BALANCES ALL THRUST

Any unbalanced thrust causes shaft to shift axially, thus regulating flow through clearance C, thereby controlling pressure against balancing disc A and thus automatically returning the pump to a state of perfect balance. Note that this hydraulic device leaves no unbalanced thrust to be taken up by bearings or other metallic contacts subject to wear.

ELIMINATES SOURCE OF TROUBLE IN HIGH-PRESSURE BOILER FEED PUMPS

The erosive action of high-temperature feed water in a high-pressure boiler-feed pump does not interfere with the operation of the De Laval automatic hydraulic balancing arrangement, since the automatic action of this device is in no way affected by normal wear, as can be seen from the illustration. Its universally trouble-free performance has been demonstrated over a period of 30 years in hundreds of installations, handling feed water up to 350° F. and discharging against pressures up to 1600 psi.

3630

TURBINES • HELICAL GEARS • WORM GEAR SPEED REDUCERS CENTRIFUGAL PUMPS • CENTRIFUGAL BLOWERS and COMPRESSORS • IMO OIL PUMPS

DE LAVAL

STEAM TURBINE COMPANY · TRENTON 2, NEW JERSEY

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AUGUST, 1945 VOLUME 89, NUMBER 8

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STEAM GENERATION, FUELS, FIRING AND COMBUSTION
TURBINES, ENGINES, AUXILIARIES; HYDRO POWER
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TRANSMISSION, LUBRICATION
STEAM SERVICES, HEATING
INSTRUMENTS, CONTROLS
PUMPS, COMPRESSORS

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Cover photo, courtesy Elliott Co

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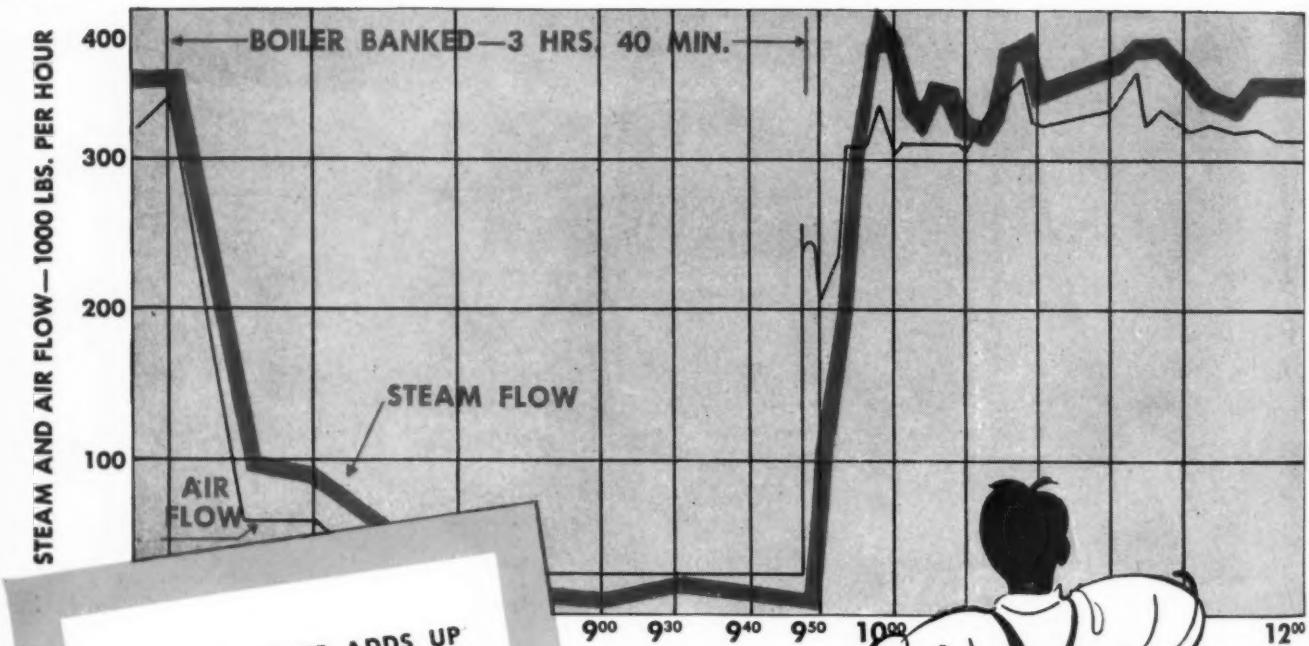
LOOK

AT THE LOAD CURVE AND YOU'LL SEE



THE LINK-GRATE ADDS UP TO THESE 10 ADVANTAGES

- Permits use of low-cost fuel
- Effectively handles all types of loads
- Assures accurate control of air flow
- Fuel bed flow is unrestricted
- Prevents formation of objectionable clinkers
- Ash discharge is continuous
- Provides high reserve capacity
- Keeps operating costs low
- Simplifies control
- Keeps installation cost low

Link-Grate Stokers meet suddenly increased steam demands with full combustion efficiency. The Link-Grate motion keeps the fuel bed porous under all conditions. The fire is always quick to respond to changes in fuel and air flow.

Westinghouse

PLANTS IN 25 CITIES... OFFICES EVERYWHERE

LINK-GRATE STOKERS

how FOLLOW THE LOAD DEMAND

The Westinghouse Link-Grate Stoker responds quickly to increased load demand. Changes in demand are immediately registered at the master control, which then acts to adjust fuel, air and draft elements. This flexibility is an outstanding characteristic of the Westinghouse Stoker . . . a result of its Link-Grate action.

Link-Grate motion maintains a regular combustion rate by continuously processing the fuel bed to keep it porous. Agitation at the rear of the stoker promotes a uniform flow of coal over the underfeed section and keeps the burning lanes open.

Grates first move up to break open the fuel bed and let low pressure air flow through the grates. The downward movement of the grates crumbles and conveys the burning fuel.

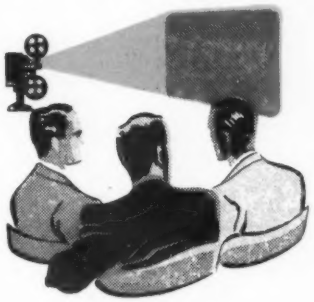
Positive movement of the fuel bed toward the continuous ash discharge eliminates periodic dumping and reduces labor. Clinkers are no problem. Link-Grate motion prevents closed pores in the fuel bed and eliminates the cause of large clinkers.

Before you make another investment in stokers be sure you have complete information about the Link-Grate. If possible, see one in operation. Your nearest Westinghouse office will be glad to arrange an appointment with a present user. Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pa.

J-50463

SEE A LINK-GRATE DEMONSTRATION IN YOUR OWN OFFICE

Almost invariably, when a stoker buyer sees a Link-Grate in action, he becomes a user. Realizing the difficulty that is often encountered by an individual or group in visiting a stoker installation, Westinghouse has prepared a new 15-minute, 16 mm sound movie, showing in detail the operation of a Link-Grate Stoker. Prints of this picture are available on loan for your private showing. Just address your request to Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa.



WESTINGHOUSE

Link-Grate

This plant COMES UP with a proven answer to a common maintenance problem

BYERS WROUGHT IRON

Every power plant has a stack problem, and it's always interesting —and frequently helpful—to see what the other fellow does about it. A good example of sound and wide-spread practice is given by this power-house stack 6'6" in diameter and 100 ft. high, illustrated here during erection at the plant of Dairy Distributors, Inc., of Watertown, Wis. Intent on getting maximum life, the engineers used Byers Wrought Iron, which has an impressive record in stack service.

The varying degree of corrosion encountered makes it impossible to say with assurance how long any individual stack will last. But in any application where an unlined metal stack can be properly used, correct design and correct materials can definitely make it last *longer*. And the weight of the evidence indicates that the "correct" material is generally wrought iron.

This letter from a user reports a typical experience. He wrote, ". . . received the parts of two smokestacks from you in 1936. These plates were installed on the upper half of two of our stacks at that time. They have been in service continuously and apparently are in good enough condition to last several years longer. During the time that these stacks have been in service, we installed stacks manufactured from common sheets which have had to be replaced, replacement being due either to condition of the gases or temperature or both."

The acids formed when carbon and sulfur compounds are absorbed by moisture will attack any commercial metal used for stacks. It is wrought iron's unusual defense, which is due to its unusual structure, that gives it durability. Tiny fibers of glass-like silicate slag, threaded through the main body of high-purity iron, halt and deflect corrosive attack, and so discourage pitting. Further, these fibers help anchor the initial protective film, which shields the underlying metal.

A review of the corrosion problems ordinarily encountered in stacks, and details of a number of wrought iron installations, are given in our bulletin, "Wrought Iron for Flue Gas Conductors and Coal Handling Equipment." We will gladly send you a copy on request.

A. M. Byers Co., Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Chicago, St. Louis, Houston, Seattle, San Francisco.

CORROSION COSTS YOU MORE THAN WROUGHT IRON

BYERS

GENUINE WROUGHT IRON

TUBULAR AND HOT ROLLED PRODUCTS

ELECTRIC FURNACE ALLOY STEELS • OPEN HEARTH ALLOY STEELS
CARBON STEEL TUBULAR PRODUCTS

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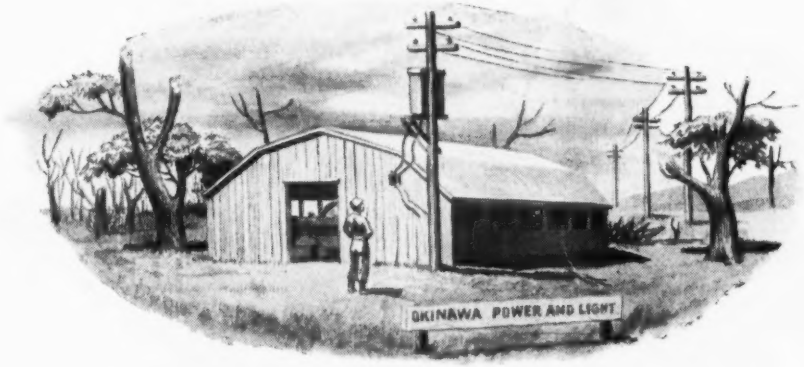


Okinawa Power and Light

CURIOSITY, INGENUITY AND KNOW-HOW of two 27th Infantry Division medical-battalion men brought electric power to one fourth of Okinawa. Sgt John Mattle, 30, of Mays Landing, N. J., and T/4 Robert Gerster, 27, of White Plains, N. Y., smiled with anticipation as they looked at the big Jap diesel in a bombed-out village.

"Let's see if we can start it," said Mattle. Gerster agreed, and they went to work scraping off the accumulation of carbon, grease and dirt.

"The big air compressor for the engine was gone," Mattle said. "We had to use our little portable jobs. This only gave us about 200 pounds and we needed about 1000 to turn her over. Just about the time we were ready to give up we stuck a spark plug in number one cylinder, and gave her some gas. Man, she really took off then."

But with the engine purring under their expert supervision, this backroom hobby of Mattle and Gerster suddenly became an important military function. Transformers were installed. High lines were checked. There was enough power for one entire end of the island. First current went to nearby hospitals. Then there was plenty left for other electric lights, ice, radios and movies.

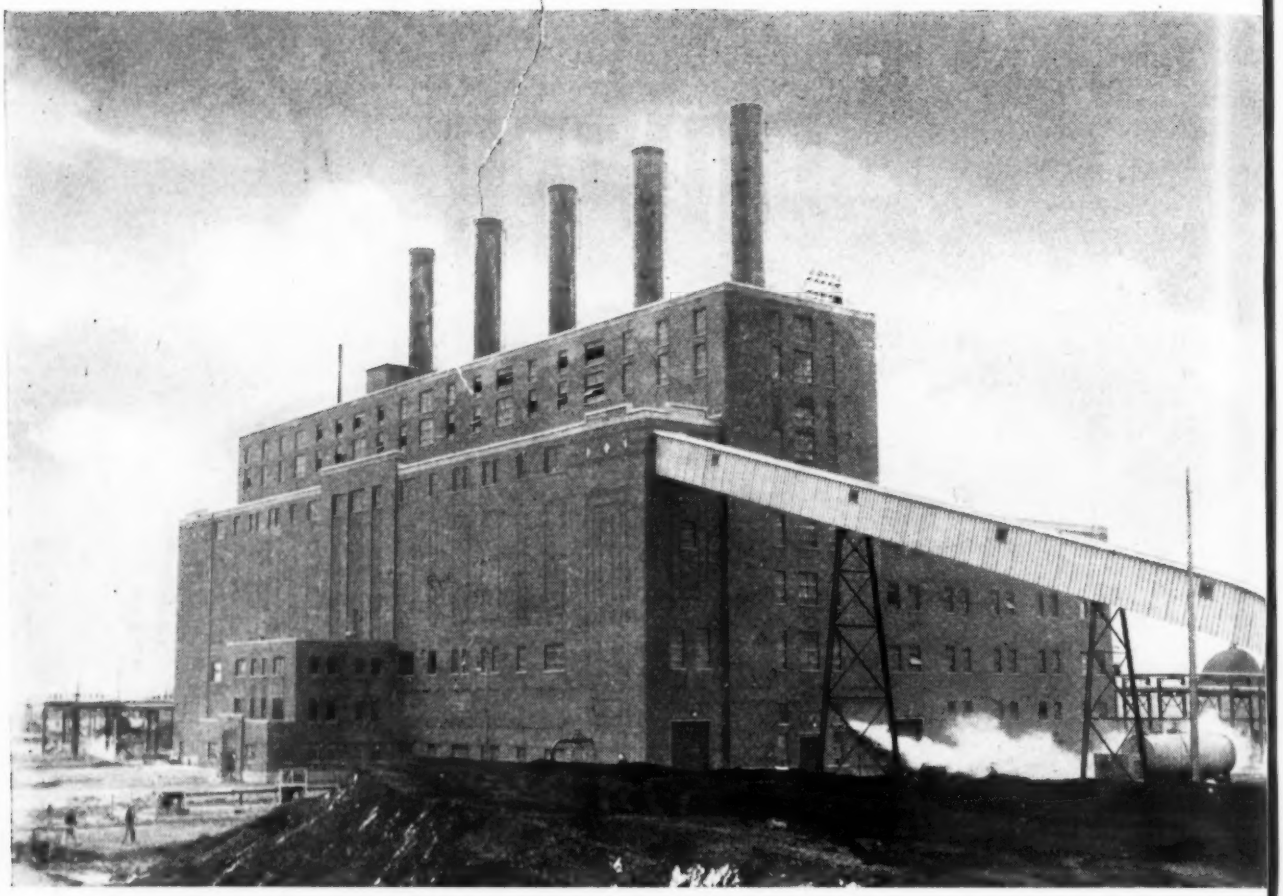
Mattle and Gerster, maintenance men with the medical battalion, now spend most of their time keeping this mongrel power plant running. Mattle studied electricity for three years at Atlantic City Trade School. Gerster says he "just picked up" what he knows.

"Gosh, we didn't know this was going to get to be such a big thing when we started," Gerster commented after Brig-Gen William B Bradford, assistant commander of the 27th Division, dropped in to offer his congratulations. Maybe we ought to install meters and call it the 'Okinawa Power and Light Company,'" added practical Sgt Mattle.

This true story warms the imagination, yet it's just a sample of what has happened hundreds of times. All round the globe American soldiers, sailors, marines, seabees and merchant mariners have shown the world how to "keep 'em rolling."

Their mechanical miracles have won deserved applause, yet we must remember that all this ingenuity is nothing new. The only new thing about it is the public recognition and the exotic background of war-torn palms, steaming swamps, desert sands and toy French villages. Doing the impossible has been routine in American power plants as far back as living engineers can remember.

As America faces the new problems of peace, the returning power engineers, and those who stayed behind to keep war production rolling, will find many uses for their mechanical resourcefulness. This pioneer quality has no effective substitute.



Canada's Largest Steam Plant Serves Synthetic-Rubber Production

This huge project, with 1,500,000-lb-per-hour steam and 27,000-kva generator capacity, produced 60,000,000 lb of rubber its first year. Two separately fired 100,000-lb-per-hour superheaters in butadiene plant supply 1400-F steam

▶ HYDROELECTRIC POWER may be the mainspring of Canada's industrial development, but the many steam plants in her large industries provide a substantial balance wheel. One of the most recent and interesting of these serves the synthetic-rubber plant of Polymer Corp, a Canadian government-owned corporation. This plant, at Sarnia, Ont., on the St. Clair River near Lake Huron, is the largest of its kind in Canada and one of the largest in the world. Size of the steam- and power-generating equipment, and the short time in which the plant had to be designed and built under wartime restrictions, make this project an outstanding engineering achievement of particular interest to power engineers.

Synthetic-rubber processes require large quantities of water and steam. Steam, needed at several different pressures and temperatures, called for the largest boilers and boiler plant in Canada. In addition, two separately fired superheaters provide steam at 1400 F.

Polymer Corp retained H G Acres & Co as consulting engineers to design and supervise construction of the steam-boiler and power plant, a water-pumping plant and a water-treating plant. The plant design was initiated in July, 1942, and by Sept, 1943, about one year after breaking ground the first boiler was ready to go into service. The plant is 286 ft long, 173 ft wide and 142 ft high from boiler-room floor to top of the recently added flyash collectors.

The site provided ample water for steam condensers and process cooling. Also, either Canada or the U. S. could supply by boat the large quantities of coal or oil required for fuel. Soil, however, was unfavorable for foundations with rock about 100 ft below the surface. Building the plant on a reinforced concrete mat, 3 ft thick, 180 ft wide and 300 ft long, has been highly successful, the building having settled very little and that evenly, without cracks.

The plant was designed and built during one of the most critical periods of the war when the amount of structural steel had to be a minimum. This led the engineers to select reinforced concrete for building material, even though they would have preferred a steel frame

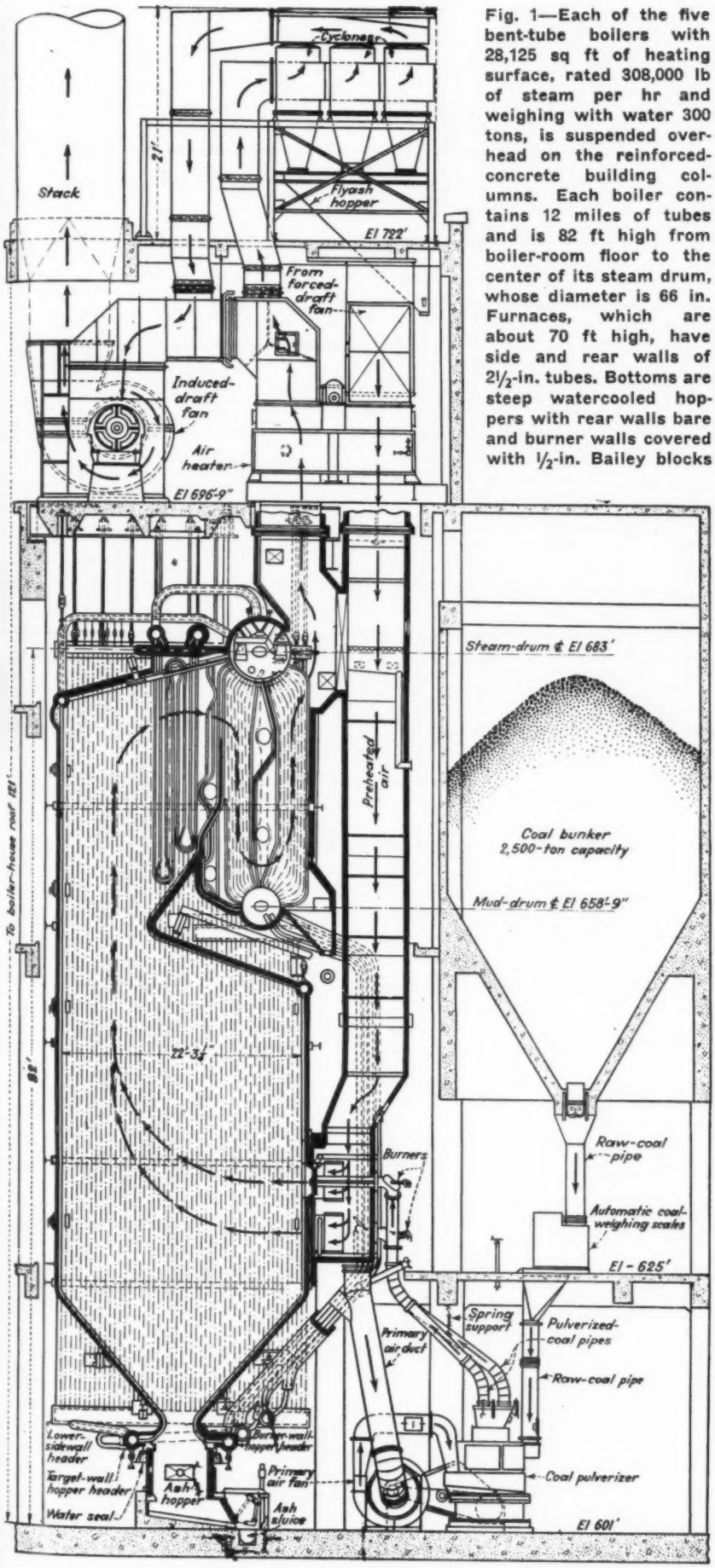


Fig. 1—Each of the five bent-tube boilers with 28,125 sq ft of heating surface, rated 308,000 lb of steam per hr and weighing with water 300 tons, is suspended overhead on the reinforced-concrete building columns. Each boiler contains 12 miles of tubes and is 82 ft high from boiler-room floor to the center of its steam drum, whose diameter is 66 in. Furnaces, which are about 70 ft high, have side and rear walls of 2½-in. tubes. Bottoms are steep watercooled hoppers with rear walls bare and burner walls covered with ½-in. Bailey blocks

Process heating and power loads required steam at several pressures and temperatures, Fig. 2. In the original conception, the plant's main elements included boilers with back-pressure steam-turbine-driven forced- and induced-draft fans, boiler-feed pumps, process-cooling-water pumps and back-pressure main turbines. These drives would have required about 23 auxiliary turbines from 250 to 1600 hp, aside from the main turbines.

Because of war restrictions the engineers could obtain only five small turbines and had to install motor drives on all boiler-plant auxiliaries except the two main boiler-feed pumps. To compensate for these restrictions on turbine drives they were given a 4000-kw extraction turbine-driven generator on order for a paper mill. But they were not permitted to purchase new main power-generating units and had to adapt to their needs two old 10,000-kw 2000-rpm 66⅔-cycle machines.

Without the complications added by the main turbines, steam was required at five levels: 400-psi process for the styrene plant; 200-psi for the butadiene plant, which left the boiler plant at 220 psi; 150-psi for general plant use, which left the boiler plant at 165 psi; a 15-psi general exhaust system extending all over the works: and 15-psi and 7-psi for feedwater heating and treating. To these, the main turbines added three more pressure and temperature levels.

Converted Turbines

The converted turbines require 200 psi at 530 F. The 4000-kw turbine was designed to extract at 125 psi and exhaust at 40 psi. Only way that it could be used was to install two stages of high-pressure feedwater heaters to absorb steam from the turbine according to power needs. These many requirements complicated the piping system with large pressure-reducing and desuperheating stations.

Further complications resulted from all process units being duplicates or modifications of units already designed in the U. S. Material lists and sources of supply had been determined. Therefore, to get into operation as quickly as possible it was necessary to adopt the designs already made rather than to work out new ones that would have simplified the steam system.

A study of the heat balance indicated that 650-psi steam pressure would be the most economical. However, large boiler drums for this pressure could not be fabricated in Canada and the steel shortage prevented obtaining them from the U. S. The engineers, accordingly, re-

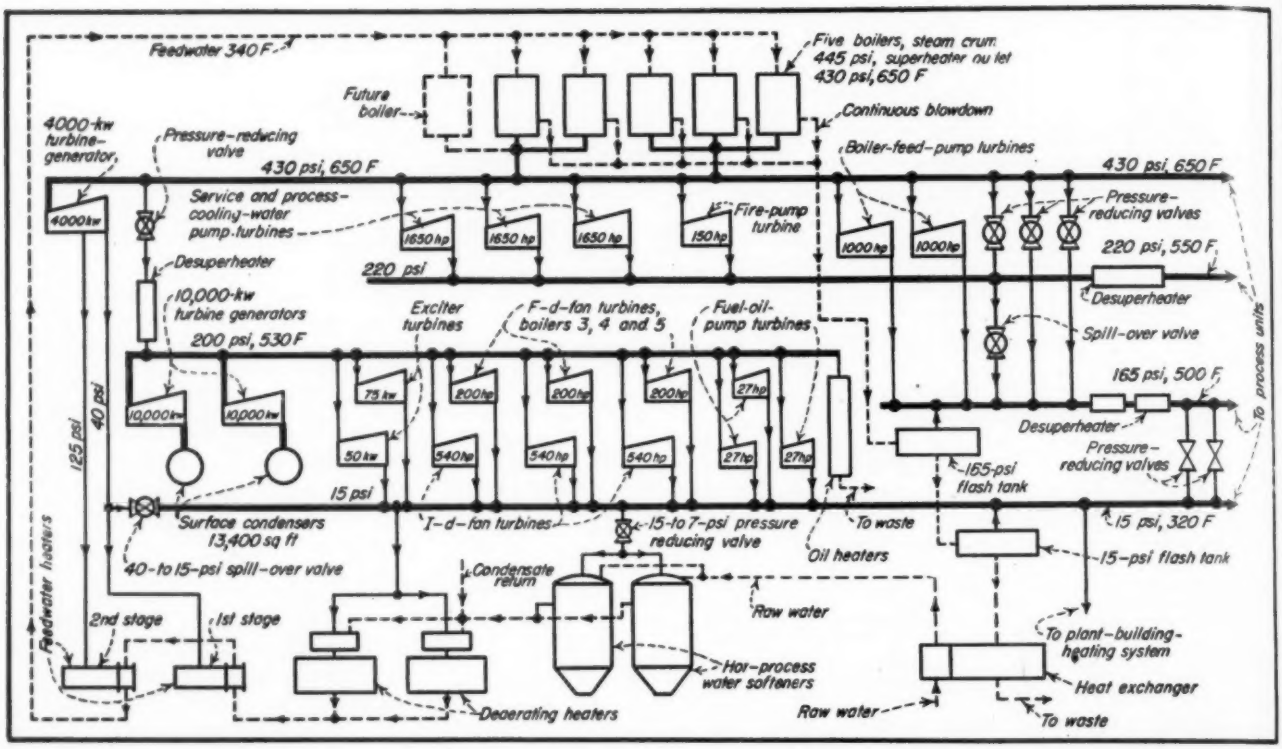


Fig. 2—Steam pressure and temperature levels for power generation and process heating and how they are obtained. Pressure of 430 psi is reduced through backpressure turbines and pressure-reducing and desuperheating stations

vised the heat balance to accommodate the highest pressure, 450 psi, for which they could obtain large boiler drums in Canada.

Decrease in steam pressure did not change the heat balance basically. It only reduced the backpressure power that would have been available from the higher-pressure steam. In the final design, available backpressure power was sufficient so that the heat balance adopted did not differ very much from what the engineers had wished to incorporate in the design.

The boiler plant is designed for five units with space for a sixth if required. They are the largest in Canada, each having a continuous rating of 275,000 lb of steam per hr with 220-F feedwater, and 308,000 lb with 340-F feedwater and designed for 460-psi drum pressure. At the superheater's outlet, steam conditions are 430 psi and 650 F.

Fig. 1 shows a cross-section of one of the 2-drum bent-tube radiant boilers with 28,125 sq ft of heating surface, including 6399 sq ft of flat projected area in the furnace waterwalls. Each boiler contains 12 miles of tubes and is 82 ft high from boiler-room floor to center of steam drum, whose inside diameter is 66 in. and length 24 ft. To provide space for the forced- and induced-draft fans and the air heaters above the boilers places the plant's roof 121 ft above the boiler-room floor.

Furnaces, which are about 70 ft high, have side and rear walls of 2½-in. tubes. Bottoms are steep watercooled hoppers with rear walls bare and burner walls covered with ½-in. Bailey blocks. Bentstud tubes surround the burners, around which chrome ore is applied. All furnace tubes are so closely spaced that outside refractories are not exposed to radiant heat of the furnace. With the exception of the stud tubes around the burners practically all tubes in furnace walls, boilers and superheaters have 2½-in. outside diameter.

Superheater Arrangement

From two headers above each boiler a superheater hangs in the furnace immediately in front of the boiler tubes. A scrubber in the steam drum delivers to the superheater dry steam that contains less than one part of solids per million. Installing the superheater in front of the boiler tubes insures practically constant steam temperature at its outlet. However, to protect the superheater from direct radiant furnace heat and to prevent slagging on its tubes, the watercooled roof below the water drum has been extended across about two thirds of the furnace width. This arrangement gives flame-and-gas travel about as indicated by long heavy arrows, Fig. 1.

Normally such boilers are supported on steel columns independent of the building, but here steel had to be conserved. To have supported the boilers on reinforced concrete columns independent of the building would have required four extra columns, 96 ft high, for each boiler placed alongside building columns. This would have increased the use of critical material and reduced the space between columns around the boilers where it was most needed. Building columns were therefore designed for suspending the boilers. This made it possible to reduce boilerhouse length by 20 ft, thus saving about 300 tons of steel besides providing a simple supporting system without cross-bracing between floors.

Fig. 1 shows arrangement of the boiler suspension, which consists of heavy I-beams resting on reinforced concrete brackets, 1 ft, 6 in. long, 2 ft, 8 in. wide and 8 ft deep, tied in with plenty of reinforcing steel stirrups to the building columns. The suspension I-beams rest on steel bearing plates in the concrete bracket tops. Because of horizontal expansion and contraction of the boilers there is considerable movement of the suspension beams on their bearing plates. To prevent freezing of these surfaces, which take a 286,000-lb vertical load each, a copper plate was placed between them. The way the boilers are suspended permits free vertical expansion and contraction. Amounting to about 2½ in., this movement is taken by a water seal between the lower end of the furnace and its ashpit, as shown at bottom of Fig. 1.

Each boiler is fired with six burners in two horizontal rows of three each, one row directly above the other. Two boilers have burners and automatic control for burning waste byproduct gases, but all five can burn either pulverized coal, or bunker C oil, or both. The automatic combustion-control system provides for burning two fuels at the same time when necessary.

Two pulverizers on each boiler connect to the six burners. They are ring-roll design arranged so that coal flows vertically from the overhead bunker to an automatic scale and then to the pulverizer feeder. A 175-hp squirrel-cage 2200-v motor drives each pulverizer and its primary air fan. This fan is driven directly from one end of the motor shaft whose other end drives the pulverizer through a multiple V-belt.

A forced-draft fan and air heater above each boiler supply combustion air at 510 F. A connection from the heated-air duct to each pulverizer provides hot air for drying the coal when necessary. An induced-draft fan, whose speed is controlled by a hydraulic coupling, discharges to a steel stack on each boiler. Originally, forced- and induced-draft fans were driven by 2200-v 200- and 400-hp synchronous motors, respectively. To insure operation in a power failure and improve the heat balance, induced- and forced-draft-fan motors on three boilers have been changed to backpressure steam turbines, equipment for this change having recently become available.

There are five boiler-feed pumps, two of which, rated 2000 gpm at 1340-ft head, are driven by 1000-hp backpressure steam turbines. The other three pumps, two rated 1000 gpm and one 300 gpm, are driven by induction motors.

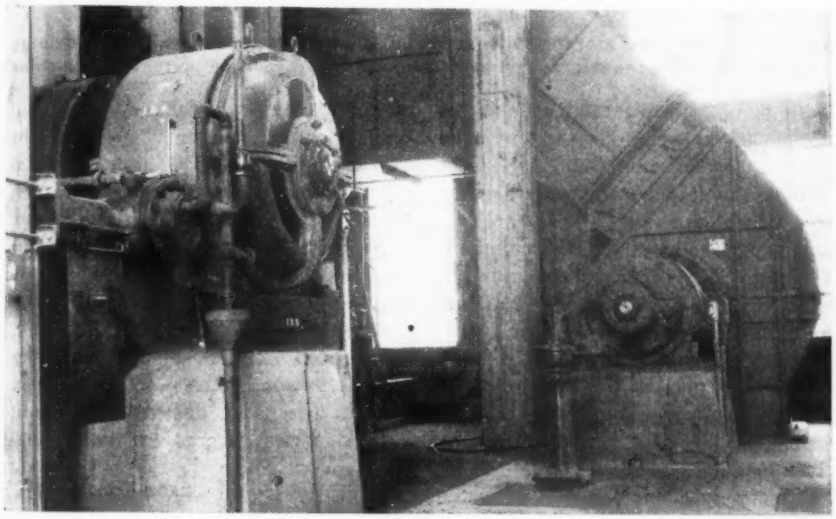


Fig. 3—Motor- and steam-turbine-driven forced- and induced-draft fans, air heaters and connecting ducts for the boilers are located on the top floor

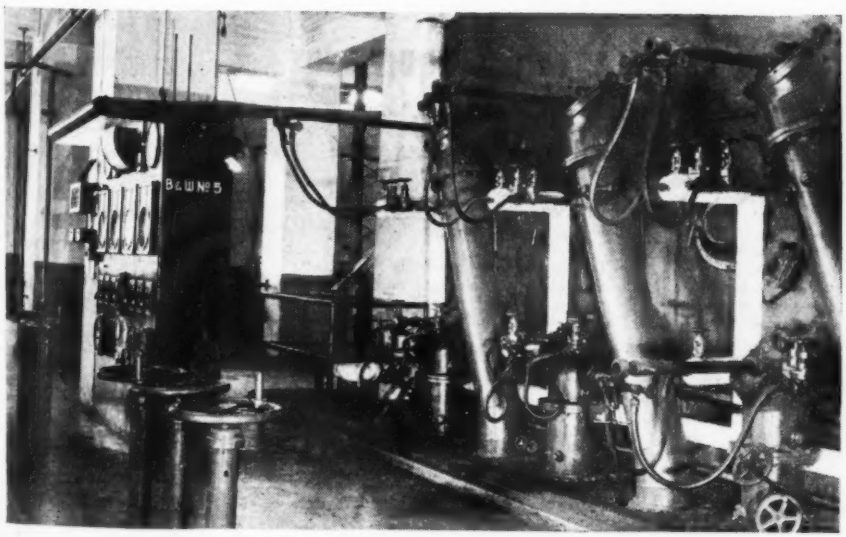


Fig. 4—Each boiler is fired by six burners in two horizontal rows of three each. Two boilers have burners and automatic control for burning waste by-product gas, but all five can burn pulverized coal or bunker C oil, or both

Makeup feedwater is raw water from the St. Clair River softened by hot-process lime-soda softeners and filtered to reduce its hardness to about 17 ppm and remove any oil contamination. Sulphuric acid is then fed to the treated water before going to deaerating heaters where the oxygen content is reduced practically to zero. Sodium sulphite fed to the water after deaeration reacts with any residual dissolved oxygen in the water. Phosphate pumped into the boilers' steam drums prevents calcium scale formation from residual hardness.

This treatment protects the boilers from oxygen corrosion and provides oxygen-free steam for superheating to 1400 F. The boiler-feedwater-treating system has a capacity of 1,600,000 lb per hr. A deaerating heater with 130,000-lb-per-hr capacity deaerates and heats condensate for the desuperheaters. Deaerating the desuperheating water was considered necessary to prevent steam that contained even a trace of oxygen going to the separately fired high-temperature superheaters in the butadiene plant.

Coal Supply by Boat

Coal is delivered by self-unloading lake boats equipped to discharge 1000 tons per hr. They unload to a belt-conveyor system that discharges to a stacker boom with a 180-deg swing over the storage yard. Tractor-propelled carryalls spread coal for storage over the pile. In the same way coal is delivered to boilerhouse belt conveyors, which first discharge to the crusher house and then to the boiler-plant coal bunkers.

The bunkers, built of reinforced concrete to save steel, extend in a row of twelve pockets along the front of the boilers. Each pocket is 21 ft square with a hopper bottom and 200-ton capacity, giving about 2500 tons total bunker capacity. After consideration of several types of bunker supports a suspended design was selected as the simplest structurally.

Ashes, removed by a hydrojet system, fall into a hopper with a sloping bottom below each furnace, from where quenchers wash them to a sloping cast-iron trough. From here sluicing nozzles wash them to an inside pit where rubber-lined centrifugal pumps transport them to an outside sump for grab-bucket removal. A cyclone-flyash-removal system is being installed on the boiler-plant roof. Flyash removed from the combustion gas on its way to the stacks will be mixed with water and pumped to the disposal ground through

2.5 miles of 4-in. underground pipe.

Power supply was one of the most serious problems in plant design because power was not available from the hydroelectric system supplying the area. Furthermore, power lines into the area were not large enough and new ones could not be obtained. Installing three turbine-generators in a building adjacent to the boiler room solved this problem.

Two of these units are 10,000-kw condensing turbines, originally installed in an auxiliary steam plant of the Dominion Power and Transmission Co, which were purchased and reconditioned. Generators on these units are rated 11,000 kva, 0.90 pf, 6600 v, 3 phase, 60 cycles. WPB assigned to the plant from the U. S. a third unit with a 4000-kw backpressure extraction turbine and a 5000-kva 0.8 pf generator, originally built for a paper mill. To provide standby service the plant's 60-cycle system can be tied to the local 25-cycle lines by two 1000-kva 2200-v frequency changers.

The plant has automatic control and meters by which it is operated under practical test conditions at all times. In the butadiene plant, two separately fired superheaters, each rated 100,000 lb per hr at 50 psi, supply process steam at the unusual temperature of 1400 F.

Synthetic rubber, as in many other industries, requires tremendous volumes of water. At Polymer, pumps for process-cooling water for condenser-cooling water for the two 10,000-kw turbines and for the fire-hydrant and sprinkler system are assembled in a plant on the river's bank near the power plant.

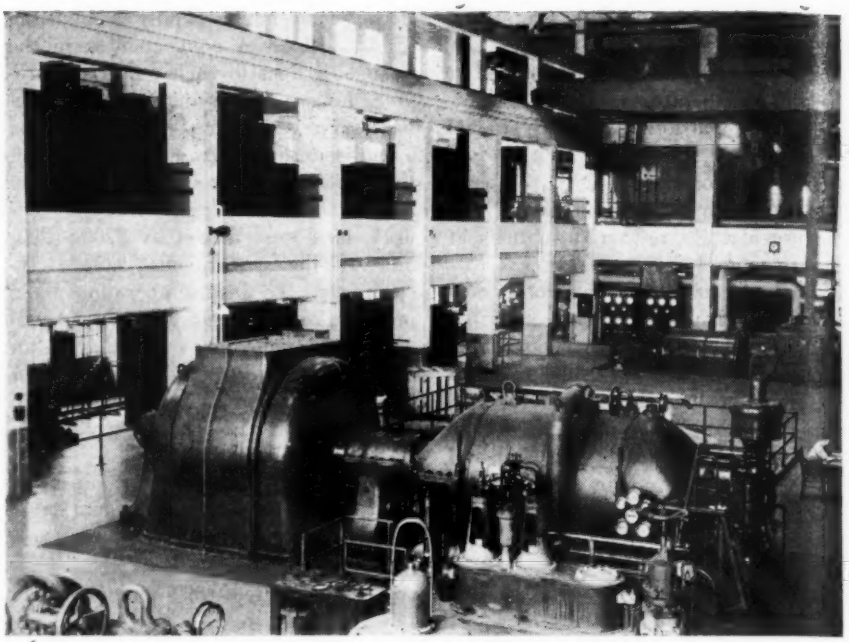


Fig. 5—Turbine-generator plant has two 10,000-kw condensing turbines driving 11,000-kva 0.9-pf generators and one 4000-kw backpressure extraction turbine

These pumps have a total capacity of 260,000,000 gal per day—water for a city of 2,000,000 population.

Process-cooling water is supplied by three 32,000-gpm 180-ft head 900-rpm main pumps and two 16,000-gpm standby pumps. The three main pumps are driven by 1650-hp 4000-rpm steam turbines, with 400-psi 650-F throttle conditions and 220-psi backpressure. The two standby pumps are driven by an 800-hp 900-rpm synchronous motor. Two vertical, 15,000-gpm propeller pumps driven by 250-hp 1200-rpm synchronous motors supply condenser cooling water for the two 10,000-kw turbines in the power plant. Water for the fire hydrant and sprinkler system is provided by two pumps rated 3500 gpm each at 130-ft head, which take suction from the process water line at 180-ft head. Thus 310-ft pressure is available at the pump discharge. A 150-hp backpressure turbine drives one pump and a 150-hp synchronous motor powers the other.

All pumps can be primed by either 400-psi steam ejectors or by vacuum pumps. Discharge lines have hydraulically operated gate valves and tilting-disk check valves. Four revolving screens, 6 ft, 6 in. wide by 26 ft high,

(*Continued on page* 136)

PRINCIPAL STEAM AND ELECTRICAL EQUIPMENT

Polymer Power and Pumping Plants

CONSULTING ENGINEER: H G ACRES & CO

GENERAL CONTRACTOR: CARTER-HALL-ALDINGER

STEAM-GENERATING EQUIPMENT:

Boilers, waterwalls and integral superheaters — Babcock-Wilcox & Goldie-McCulloch
Boilers, 5, radiant, 2 drum, bent tube, each 28,125 sq ft heating surface including 6399 sq ft of flat projected area in *waterwalls* made up of bare tubes, Bailey block and stud tubes; 308,000 lb per hr rated continuous steaming capacity, 460-psi design pressure, 430 psi at superheater outlet; 25,700 cu ft furnace volume; 14,500 Btu maximum heat release per cu ft per hr; *integral superheaters*, continuous tubes, 650 F total temp at rated boiler capacity

Air heaters — Superheater Co
Ljungstrom, 28,300 sq ft; gas temp: 705 F in, 370 F out; 510 F air temp

Air-heater drive motors — Canadian Allis-Chalmers
Five, 3 hp, 550 v, 1200 rpm, squirrel cage

Boiler refractories, castable — Plibrico Jointless Firebrick Co

Heat insulation — Atlas Asbestos Co

Soot blowers — Diamond Specialty

Boiler ducts and breechings — Babcock-Wilcox & Goldie-McCulloch

Stacks — Sarnia Bridge Co
Five, steel, 10 ft, 6 in. inside dia, 180 ft above boiler-room floor, 60 ft above boiler-plant roof

COMBUSTION EQUIPMENT:

Coal pulverizers, feeders and primary-air blowers — Babcock-Wilcox & Goldie-McCulloch
Two pulverizers per boiler, ring roll, 17,000 lb per hr each; coal 62 grindability; proximate analysis, %: moisture 4, volatile 34.6, fixed carbon 52.8, ash 8.6; ash-softening temp 2300 F

Coal-pulverizer and primary-air fan-drive motors — Commonwealth Elec Corp
Ten, 175 hp, 2200 v, 1800 rpm, squirrel cage

Pulverizer-drive-motor starters and feeder motors — Canadian GE Co

Coal-feeder controllers — Bailey Meter Co

Pulverizer coal, oil, gas burners — Babcock-Wilcox & Goldie-McCulloch
Circular, 6 per boiler

Fuel-oil storage tanks, two 6000 bbl each — Toronto Iron Works

Oil suction heaters, 2 per tank, 135 gpm each, 40 to 100 F — Darling Bros

Oil pumping and heating units, 3 — F J Raskin

Oil-pressure heaters, three, 90 gpm from 80 to 220 F — Darling Bros

Screw pumps, three, 90 gpm — Quimby Pump Co

Steam-turbine pump drives — Coppus Engineering Co
Three, 27 hp, 200-psi steam, 530 F, 15-psi exhaust

Automatic coal scales — Richardson Scale Co of Canada
Two per boiler, 15 ton per hr each, 200 lb per dump

Automatic combustion control — Bailey Meter Co

F-d fans.....Canadian Blower & Forge Co
One per boiler, 3 turbine- and 2 motor-driven, 405,000 lb per hr at 9.2 in. wg and 105 F
F-d-fan turbines and gears.....Moore Steam Turbine Div, Worthington
Three, 200 hp, 200-psi steam, 530 F, 15-psi backpressure
F-d fan motors.....Commonwealth Elec Corp
Two 200 hp, 1200 rpm, 2200 v, synchronous
I-d fans.....Canadian Blower & Forge Co
One per boiler, 3 turbine- and 2-motor driven, 518,000 lb per hr at 8.8 in. wg and 402 F
I-d-fan turbines and gears.....Moore Steam Turbine Div, Worthington
Three, 540 hp, 200-psi steam, 550 F, 15-psi backpressure
I-d fan motors.....Commonwealth Elec Corp
Two, 400 hp, 900 rpm, 2200 v, synchronous
Draft-fan motor starters.....Canadian General Elec Co
I-d-fan hydraulic couplings.....Canadian Sirocco

COAL-HANDLING EQUIPMENT:

Coal-dock belt conveyors, 2 in tandem, 1000 tons per hr..Jeffrey Mfg Co
Storage-yard stacker boom, 1000 tons per hr.....Jeffrey Mfg Co
Coal-storage carryall scrapers.....R G LeTourneau
Belt conveyors, two, 30-in. belts, 300 tons hr.....United Steel Corp
Coal bunker, concrete, 2500-ton capacity
Vibrating coal feeder.....Jeffrey Mfg Co
Magnetic separator.....Dings Magnetic Separator Co
Coal crushers, 2, each 200 tons per hr.....Link-Belt Co
Automatic coal sampler.....Thorsten
Coal-handling-equipment motors.....English Electric Co of Canada
Coal-handling-equipment-motor starters.....Canadian Controllers

ASH-DISPOSAL EQUIPMENT:

Ash hoppers and sluicing equipment.....Allen-Sherman-Hoff Co
Flyash collection-and-disposal system collectors.....Buell Engrg Co
Flyash-collector duct work.....Horton Steel Works
Flyash-collector structural steel.....Sarnia Bridge Co
Heat insulation.....Norman A Smith
Hydro-mix valves and flyash-disposal pumps.....Allen-Sherman-Hoff Co
Pump motors, four, 15 hp, 1800-rpm, 550 v.....Canadian GE Co
Recycle slurry pumps, 2.....Allen-Sherman-Hoff Co
Slurry-pump motors, two, 15 hp.....English Electric Co of Canada
Water booster pumps, 2.....Worthington Pump & Mach Corp
Booster-pump motors, two, 7.5 hp.....English Electric Co of Canada
Starters on ash-pump motors.....Canadian General Electric Co
Pipe.....Page Hersey Tubes
Pipe installation.....Shaw Construction Co
2.5 miles of 4-in. welded pipe underground to disposal ground

VALVES:

Safety valves (Consolidated).....Manning, Maxwell & Moore
Blowdown valves.....Yarnall Waring Co
Nonreturn valves.....Crane Co; Edwards Valve Mfg Co; Smolensky
600-lb valves.....Crane Co; Reading, Pratt & Cady; James Morrison Brass Mfg Co; Manning, Maxwell & Moore; Edwards Valve Mfg Co; Chapman Valve Mfg Co; Lunkenheimer Co; Sandilands Valve Mfg Co; Hopkinson, Ltd; Walworth Co; Smolensky
300-lb valves....Crane Co; Hopkinson, Ltd; Sandilands Valve Mfg Co; Chapman Valve Mfg Co; Edwards Valve Mfg Co; Lunkenheimer Co
150-lb valves.....Crane Co
125-lb valves.....Crane Co; Jenkins Bros
Reducing, spill-over and backpressure valves.....Bailey Meter Co
Atmospheric relief valves (Cochrane).....Canadian Allis-Chalmers
Electric-valve operators.....Philadelphia Gear Works

PIPING TRAPS AND STRAINERS:

Piping contractor.....Canadian Kellogg Co
Pipe heat insulation.....Robert T Purves
Traps.....Canadian Armstrong Machine Works; Strong Carlisle & Hammond Co; Yarnall Waring Co
Strainers.....Canadian Armstrong Machine Works; Strong Carlisle & Hammond Co

FEEDWATER SYSTEM:

Water conditioning (Hall Laboratories).....Dominion Flow Meter Co
Water columns.....Diamond Specialty
Feedwater control, 3 element, air operated.....Bailey Meter Co
Acid-valve controllers.....Leeds & Northrup Co
Feed pumps, geared-turbine driven.....Canadian Ingersoll-Rand Co
Two, 1,000,000 lb per hr, 1340-ft head, 1800 rpm
Feed-pump turbines and gears...Moore Steam Turbine Div, Worthington
Two, 1000 hp, 4000 rpm, 400-psi steam, 650 F, 155-psi backpressure
Feed pumps.....Canadian Ingersoll-Rand Co
Two, motor driven, 500,000 lb per hr, 1340-ft head, 1800 rpm
Feed-pump motors.....Canadian Westinghouse Co
Two, 600 hp, 1800 rpm, 2200 v, squirrel cage
Feed pump.....Canadian Ingersoll-Rand Co
One, motor driven, 150,000 lb per hr, 1340-ft head, 3600 rpm
Feed-pump motor.....English Electric Co of Canada
One, 175 hp, 3600 rpm, 2200 v, squirrel cage
Feed-pump motor starters.....Canadian General Elec Co
Feedwater-treatment equipment.....Canadian Allis-Chalmers
For lime-soda process: chemical feeders, filters, storage tanks, continuous blowdown, flash tanks and control (Cochrane)
Feedwater deaerating heaters (Cochrane).....Canadian Allis-Chalmers
Two, 800,000 lb per hr each
Feedwater heaters.....Foster Wheeler Corp
Desuperheaters and controls.....Bailey Meter Co
Desuperheater-water deaerator.....Canadian Allis-Chalmers
One, 130,000 lb per hr
Desuperheater water pumps.....Canadian Allis-Chalmers
Three, 45,000 lb per hr or 90 gpm, 1050-ft head, 3600 rpm
Desuperheater-pump motors.....Canadian Allis-Chalmers

METERS:

Boiler and turbine meter and control boards.....Bailey Meter Co
Feedwater-treatment control board (Cochrane)..Canadian Allis-Chalmers
Pressure-reducing station boards.....Bailey Meter Co
Boiler meters, steam flowmeters, gas flowmeters, pressure recorders, temperature recorders, feedwater flowmeters, water meters, condensate meters, blowdown meters, boiler-water-level recorders, boiler-load indicators and draft gages.....Bailey Meter Co
Feedwater flowmeter (Cochrane).....Canadian Allis-Chalmers
Liquid-level recorders.....Bailey Meter Co
Pressure gages....Morrison Brass Mfg. Co; Manning, Maxwell & Moore
Turbine pressure-and-temperature recorders.....Bailey Meter Co
Turbine speed indicators.....James G Biddle Co
Vacuum columns.....Hohmann & Maurer Mfg Co
Vacuum gages.....Manning, Maxwell & Moore
Thermometers, industrial.....Taylor Instrument Cos of Canada
Pyrometers and dial thermometers.....Foxboro Co
Generator-temperature indicators.....Westinghouse Elec Corp
pH recorder.....Leeds & Northrup Co
Flue-gas analyzer (orsat apparatus).....Bailey Meter Co

POWER GENERATING UNITS:

Turbine-generators.....Westinghouse Elec Corp
Two condensing turbines, 10,000 kw, 1800 rpm, steam conditions—throttle 200 psi, 530 F; 1 *noncondensing turbine*, 4000 kw, 3600 rpm, steam conditions—throttle 430 psi, 650 F, bleed 125 psi, exhaust 40 psi; 2 *generators*, 14,000 kva, 0.9 pf; 1 *generator*, 5000 kva, 0.80 pf, 6600 v, 60 cycle, 3 phase
Generator air coolers.....Unifin Tube Co
Oil coolers.....Westinghouse Elec Corp
Oil purifiers.....De Laval Co
Surface condensers, two, 13,400 sq ft each.....Westinghouse Elec Co
Circulating-water pumps are in pumping plant
Condensate pumps.....Canadian Ingersoll-Rand Co
Two, 430 gpm, 120-ft head, 1800 rpm
Condensate pump motors.....Canadian General Elec Co
Exciters: 2 turbine driven, one 50 kw and one 75 kw, 125 v
Turbines.....Babcock-Wilcox & Goldie-McCulloch
Steam conditions, throttle 200 psi, 550 F, exhaust 15 psi
Generators.....Westinghouse Elec Corp
Frequency changer (Lancashire Dynamo & Motor Co)...Bepco, Canada
One, 1000 kva, 2300 v, 25 cycle to 2300 v, 60 cycle
Frequency changer.....General Electric Co
One, 1000 kva, 2300 v, 25 cycle to 6600 v, 58 1/3 cycles
Switchboards, switchgear and reactors.....Canadian General Electric Co
Transformers, distribution.....Moloney Elec Co of Canada
Ten, 600 kva, 3 phase, 6600 to 575 v
Transformers, distribution.....Ferranti Electric
Ten, 600 kva, 3 phase, 6600 to 575 v
Transformers, auxiliary.....Canadian Westinghouse Co
Two, 5000 kva, 3 phase, 6600 to 2300 v; 2, 750 kva, 3 phase, 2300 to 575 v
Traveling cranes.....Herbert Morris Crane Co

COMPRESSED-AIR EQUIPMENT:

Air compressors.....Canadian Ingersoll-Rand Co
Two, 1040 cfm, 110 psi, 900 rpm
Air-compressor motors and starters.....Canadian General Electric Co
One motor: 200 hp, 900 rpm, 2200 v, synchronous; one motor: 200 hp, 900 rpm, 550 v, synchronous
Control air compressors.....Canadian Ingersoll-Rand Co; Reavell Co (Canada)
One, motor driven, 230 cfm, 100 psi, 870 rpm; 1 gasoline-engine driven, 212 cfm, 100 psi, 480 rpm
Air-compressor motor, 50 hp, 1760 rpm, 550 v.....Canadian GE Co
Air-compressor gasoline engine, 50 hp, 480 rpm.....Atlas Polar Co

PUMPING PLANTS:

Condenser-circulating-water pumps.....Canadian Ingersoll-Rand Co
Three, vertical propeller, motor driven, 15,000 gpm, 50-ft head
Circulating-water pump motors and starters..Canadian General Elec. Co
Three, 250 hp, 1200 rpm, 2200 v, squirrel cage
Process-cooling-water pumps.....Canadian Ingersoll-Rand Co
Five: 3 tandem, geared-turbine driven, 32,000 gpm, 180-ft head, 900 rpm
Turbines and reducing gears....Moore Steam Turbine Div, Worthington
Three: 1650 hp, 4000 rpm, steam conditions—throttle 430 psi, 650 F, 220-psi backpressure; 2, motor driven, 16,000 gpm, 180-ft head
Process-cooling-water pump motors.....Commonwealth Elec Corp
Two, 800 hp, 900 rpm, 2200 v, synchronous
Synchronous-motor starters.....Canadian General Electric Co
Fire and sprinkler pumps.....Northern Foundry & Machine Co
Two, one turbine- and one motor-driven, 3500 gpm, 130-ft head
Fire-pump turbine.....Moore Steam Turbine Div, Worthington
150 hp, 1800 rpm, steam 430 psi, 650 F, backpressure 220 psi
Fire-pump motor.....Canadian Westinghouse Co
150 hp, 1800 rpm, 2200 v, squirrel cage
Fire-pump motor starter.....Canadian General Electric Co
Priming ejectors.....Schutte & Koerting Co
Priming vacuum pumps (Nash).....Canada Pumps
Intake screens and reduction gears.....Link-Belt Co
Four, revolving, motor driven, 6 ft, 6 in. by 26 ft high, 10 ft per min
Screen-drive motors and starters.....Canadian General Elec Co
Sluice gates, four 6x6 ft.....Dominion Engineering Co
Check valves.....Dominion Engineering Co
Ten, 24-in., one 14-in. and two 12-in., tilting disk
Gate valves.....Dominion Engineering Co
Ten 24-in., hydraulically operated
Butterfly valves.....Canadian Allis-Chalmers
Traveling crane.....Herbert Morris Crane Co
Water meters.....Builders-Providence Corp

Coal-Flow Studies in Plastic Models Point Way to Nonplugging Designs

Digest of recent ASME paper by E F Wolf, test engineer, and H L Hohenstein, assistant to electrical engineer, Consolidated Gas Elec & Power Co, Baltimore. Transparent-model tests, plus coal-property studies, point way to redesigning chutes and hoppers for uninterrupted coal flow

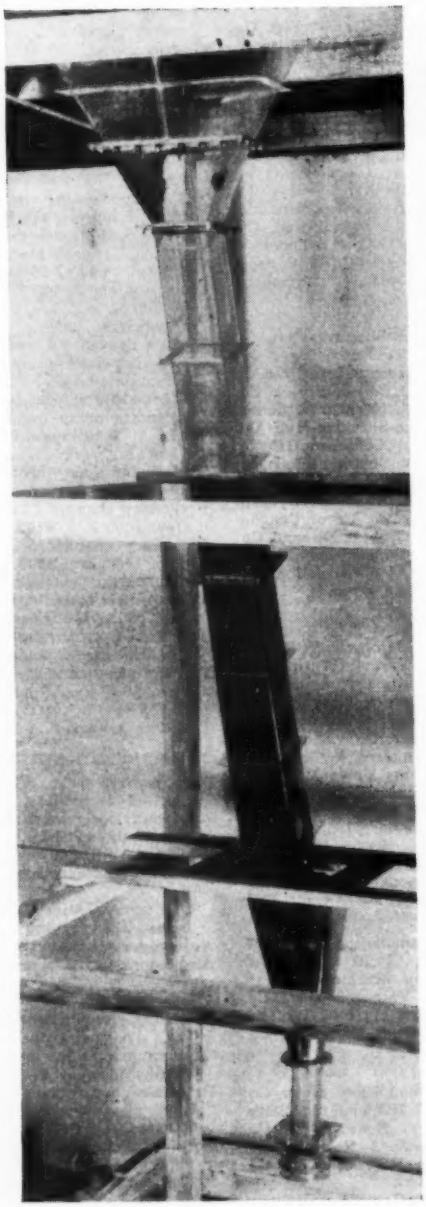


Fig. 1—Transparent model of existing hopper shows two ways that coal sticks. Note coal hanging at left in upper hopper, also complete blocking of flow at bottom of lower hopper

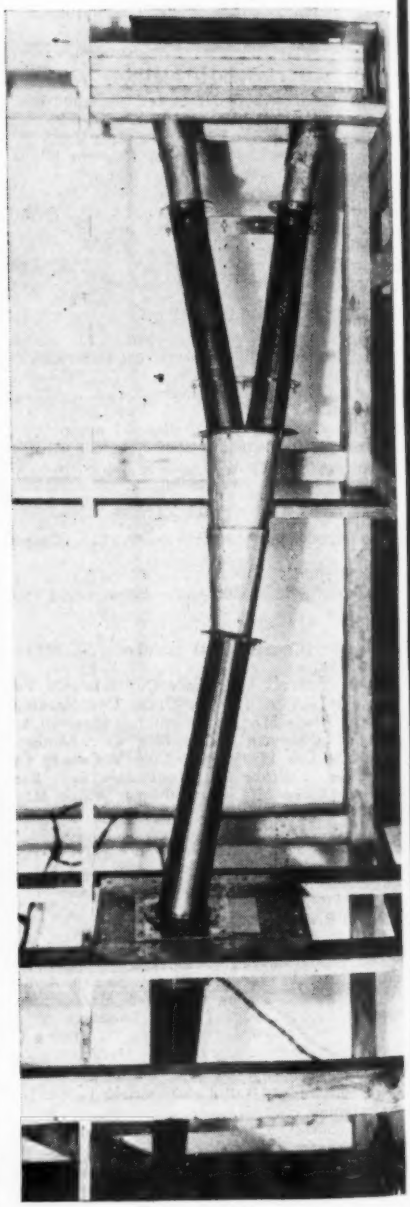


Fig. 2—Model of final design. Upper hopper and converging section are fabricated from pyralin-lined tinplate. This year a full-sized chute will check the results of laboratory tests

▶ NOW THAT ONE BOILER per turbine is common practice, it is vitally important to prevent coal stoppage. The coal chutes installed at the Westport extension and the new Riverside Generating Station, in connection with the expansion program that Consolidated Gas Electric Light & Power Co began in 1939, represented the best engineering knowledge available up to that time. In general, chutes were kept as steep as possible, flared where practicable, with hopper sides sloping 60 deg, or steeper.

Existing Chute Designs

This chute design performed well with moderately dry coal, but coal excessively wet from wartime handling (especially at Riverside) frequently ratholed and arched in the bunkers and often plugged the chutes connecting bunker to pulverizing mills. These difficulties first occurred in the winter and early spring of 1943-44, when government fuel regulations forced extensive use of excessively moist coal from lot storage.

Studies conducted to cure these difficulties included (1) study of the flow and stoppage of coal in a transparent plastic scale model of one of the chutes (2) measurement of physical properties of lot coal to study the cause and factors affecting stoppage (3) development of an improved chute design in scale-model form.

To keep down outages and cost, the experimenters sought designs that would improve coal flow without requiring too many costly structural changes in the existing installation.

New models developed from these tests handle, without stoppage, coal one and one half times as moist as can the model of the existing chute. The final model (Fig. 2) permits unimpeded flow of coal of a moisture content that ratholes, arches and sticks in the model of the existing bunker (Fig. 1). A full-sized coal chute conforming to the final model design will be placed in operation this year to check laboratory results.

Stoppages with lot-storage coal have been most frequent at the Riverside plant. It appears that the stocking out and reclaiming of coal by bulldozer and

scraper at Riverside, and the resulting greater compacting of the coal, increases the percentage of fines and thus allows the coal to retain more moisture. The coal used at both stations is semi-bituminous produced in District No. 1 from the central Pennsylvania and northern West Virginia regions.

Coal delivered to Riverside plant by barges generally flows through the chute system with little difficulty, while lot-stored coal of similar moisture content gives much trouble. Sieve analyses indicate that the lot coal contains about one third more material below 20 mesh than does the scow coal.

Each of the two turbine-generators at Riverside Station is served by one 550,000-lb-per-hr boiler taking its coal from a 990-ton catenary bunker. The bottom of this bunker is at elevation 72. Serving one boiler, three chutes, each fed by two clamshell gates, carry the coal to the three pulverizing mills at elevation 10 in the boilerhouse basement. Because the center chute (Fig. 3 east elevation) proved the most troublesome in operation, it was selected for this investigation.

Since it was impossible to determine either the exact location or the nature of each stoppage in the steel coal chutes at the plant, it was decided to make an exact transparent scale model of the center chute. Thirty-mil sheet pyralin was molded under boiling water over polished-wood templets conforming to exact inside dimensions, one tenth scale.

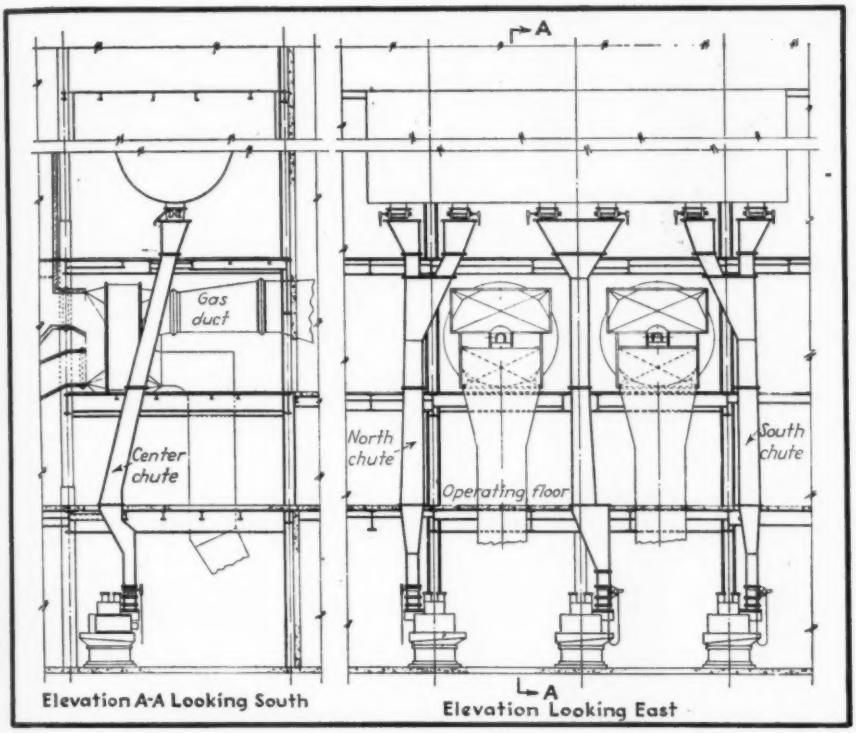


Fig. 3—General assembly of existing chutes at Riverside shows obstructions to possible changes. Center chute (east elevation) proved most troublesome

Size of Coal Used

In some experiments with this model specially prepared coal samples were used, with particles reduced approximately to the model scale. Most of the experiments, however, were carried out with coal samples taken directly from lot storage, slightly modified by removing lumps larger than ½ in. A revolving table feeder at the model outlet simulates the action of the table feeder at Riverside. Phenomena observed in the actual chute have been reproduced to a surprising degree in the model with either gradation of coal. Sticking and hanging up have occurred in the model at the same location and in the same manner as in the actual plant chute.

No attempt was made to arrive at a mathematical expression of the scale factor. However, it was found that all the phenomena noted in the actual chute at an observed moisture content of 5.5 to 6% occurred in the model at 3.5 to 3.75%. Dry coal flowed smoothly and uniformly in the model of the existing chute as it did in the actual chute. At about 2.5% moisture the flow in the model became very sluggish along the corner at least slope in the hopper below the operating level (elevation 31 ft, 6 in., Fig. 3).

Effect of Moisture

With increasing moisture the coal began to rathole intermittently by draining entirely from the vertical corner and leaving the remainder of the hopper packed with coal. In the range from 3 to 3.5% moisture stoppages occurred at the bottom of the hopper and at the hopperlike shape simulating the coal gate. Also voids began to form in the rectangular tapering chute above the operating floor. With further increase in moisture, flow of coal could be maintained through the lower hopper by scale-sized pokers and air lances, but

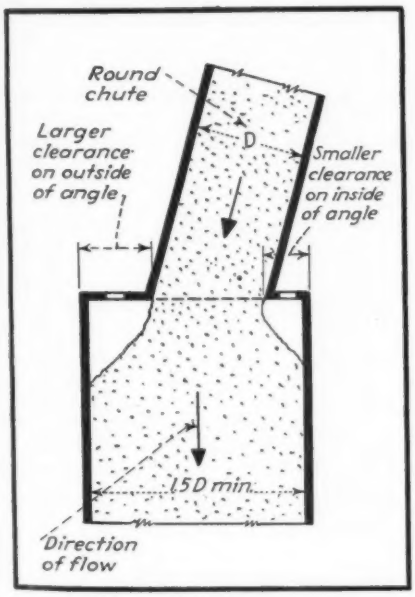


Fig. 4—Diagram of "break away." The tests proved that coal flows best from chute to hopper with substantial free space around lower end of chute

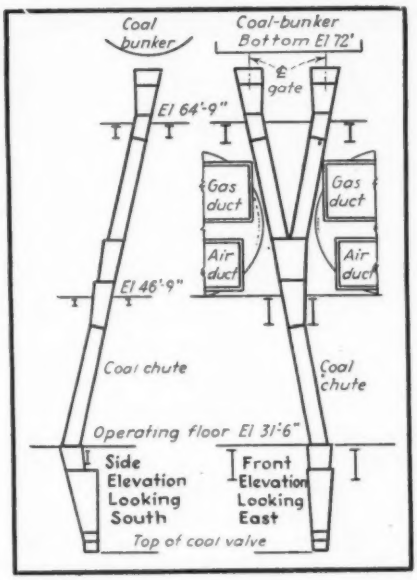


Fig. 5—General assembly of new coal chutes made of round or oval sections. Note trend to streamlining with compromises to simplify construction

arching and ratholing then took place at the upper hopper.

In this chute system the cross-section reduces from a 41.7-sq-ft rectangle at the top to a 1.7-sq-ft circle at the bottom. This tends to compact the coal, a primary cause of the observed stoppages at the hopper bottoms, in corners, and at points of changed direction of flow.

Special Coal Tests

Aside from the model experiments special tests were made to relate moisture content, degree of compacting, static angle of repose, and other physical properties. Fig. 8 shows the effect of moisture and the degree of compacting on the static angle of repose. Note that a fully compacted sample containing more than 3.5% moisture has a 90-deg angle of repose, that is, it can hold a vertical coal face without support. Fig. 9 shows how moisture content affects the angle of slide in a 3-in. steel tube 36 in. long.

Fig. 6 shows the results of tests made with 12-in. long steel cones to determine the effect of cone taper on stoppages. A comparison of the curves shows the pronounced effect of compacting, particularly in cones that taper gradually.

One general conclusion from the tests reported in this paper is that the slope of the chute should be at least 75 deg if moisture contents higher than 3% are expected. The value of flaring or expanding cross-sections was clearly demonstrated.

Reducing sections are troublemakers. If moisture exceeds 4% even a very small restriction at the end of a vertical chute can completely block the flow. In the model of the existing chute, as well as in the plant, the hoppers are focal points of trouble.

During model tests, the vertical load that the coal exerted at bottom of the chute system was measured and found to be approximately equal to the weight of a column of coal one dia high. Other tests in a 3-in. cylinder, 36 in. high, showed that with fairly dry coal, about 80% of column weight was carried by side-wall friction.

Models of new design were built to try out the principles established by these tests. These principles are: (1) Avoid sudden constrictions and sharp changes in direction. (2) Use minimum angles of convergence of lines of flow, preferably approaching zero. (3) Use maximum practical taper in hoppers. (4) Keep flow lines as near vertical as possible throughout the system. (5) Use round sections in preference to square or rectangular.

Because existing structural limitations in the plant had to be considered, it was not possible to apply these ideas fully. Fig. 2 and 7 show the final design adopted.

Fig. 4 shows an important test discovery in schematic form. For a maximum freedom of flow from a chute to a hopper the hopper should break away sharply from the chute to allow free expansion of the coal in all directions.

This investigation (reported in considerably greater detail in the original paper) was carried out under the general direction of A L Penniman, Jr, general superintendent of the Consolidated Gas Electric Light & Power Co, of Baltimore.

Fig. 7—Side view of final design of the hopper located below the operating level. Offset at the upper portion was made necessary by obstructions

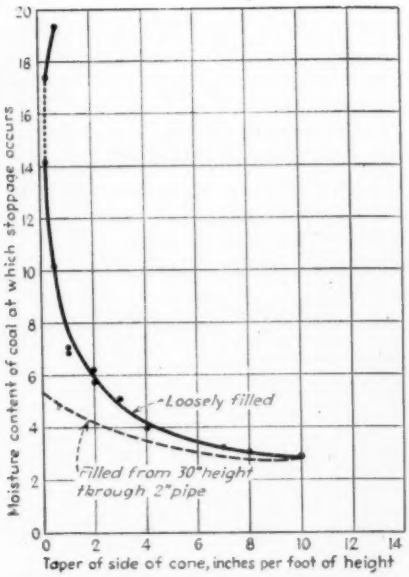

Moisture content of coal at which stoppage occurs
Loosely filled
Filled from 30" height through 2" pipe
Taper of side of cone, inches per foot of height

Fig. 6—Effect of taper on flow of coal in a converging, concentric, vertical steel cone of 2-in. outlet dia. In each case cone is 12 in. high

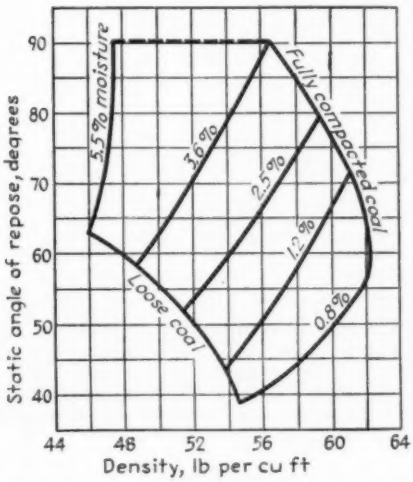


Fig. 8—Effect of moisture content of coal, together with degree of compacting, on the static angle of repose

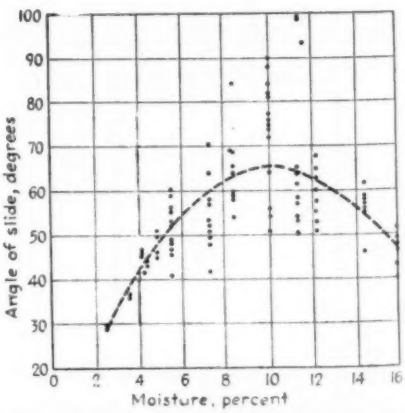
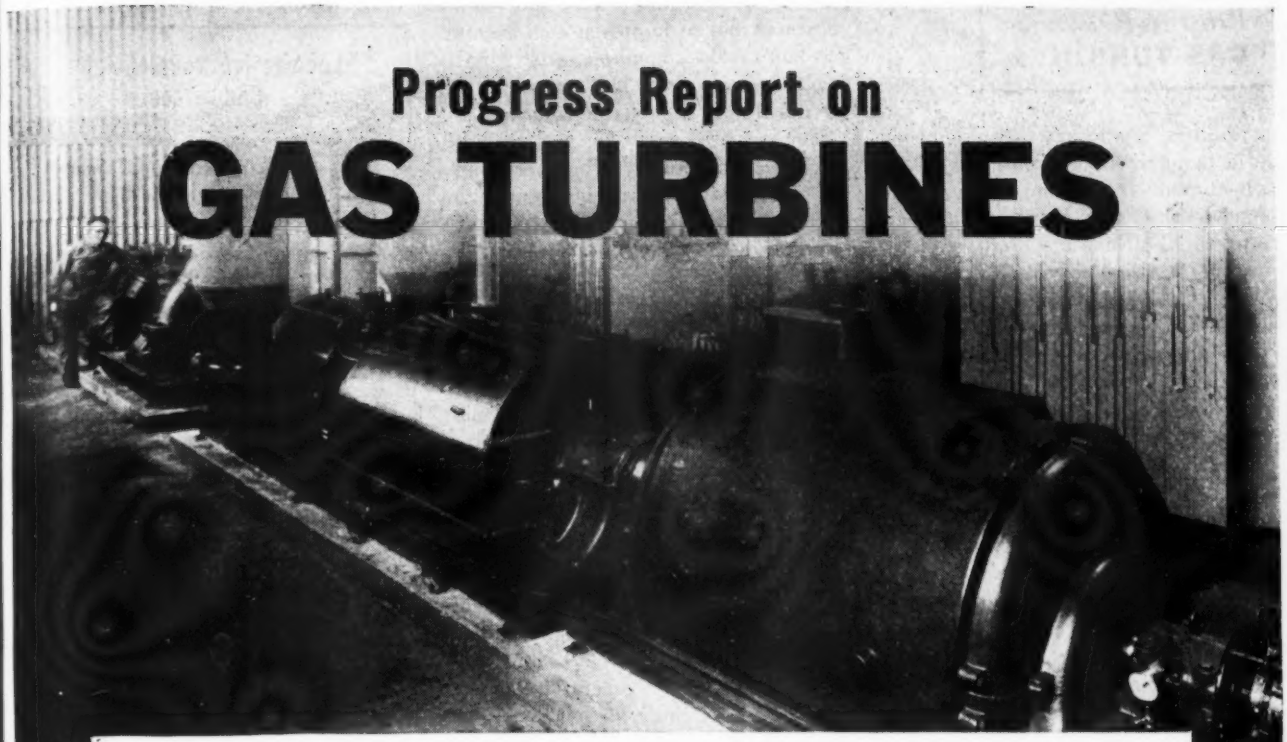


Fig. 9—Effect of moisture content on angle of slide. Tests made with a 3-in.-diameter steel tube 36 in. long

Progress Report on GAS TURBINES



1 Outline of research program aimed at developing coal-burning gas-turbine locomotive **2** Engineering and combustion aspects of first successful American-built power unit, using rotary compressor **3** Test results of 2000-kw closed-cycle unit **4** Operating experience with gas turbines in oil-refinery service

The Gas Turbine Looks to Coal

By J I YELLOTT
Director of Research
Locomotive Development Committee
Bituminous Coal Research, Inc

▶THE FUTURE of the combustion gas turbine in stationary and railroad fields ties closely to its ability to use bituminous coal as fuel. Although lower in thermal efficiency at present temperatures than the diesel, the simple gas turbine with low-cost coal as fuel will compete with any oil-burning prime mover. Moreover, economic future of eastern U. S. railroads ties closely to continued large-scale use of coal, not only by industry and the nation as a whole, but also by the roads themselves. Carrying coal is one of the railroads' most important tasks; 98% of the nation's coal moves by rail from the mines. Employment for hundreds of thousands of men in all activities from mining to locomotive firing depends on continued use of coal in large quantities.

In search of improved motive power, American railroads have begun the most intensive program of research and development in the industry's history. Motivated not only by need for locomotives of higher availability but also by deep interest in continued use of bituminous coal for railroad purposes, officers of six major Eastern roads and three large coal companies have associated themselves with Bituminous Coal Research, Inc, as the Locomotive Development Committee.

This group has as its responsibility the development of coal-burning locomotives of increased availability and higher thermal efficiency. After carefully considering available means for powering locomotives, the committee decided to concentrate on the coal-burning gas turbine.

At present, the reciprocating engine still dominates the field and many thousands of these units are hauling wartime loads with excellent records. Railroads and engine builders are carrying on constant improvement of the conventional locomotive, but the reciprocating engine is rapidly approaching its ultimate in size and power. In addition, present methods of burning coal in locomotive fireboxes have already passed the point of maximum efficiency.

The steam turbine offers attractive

Progress Report on
GAS TURBINES

possibilities for locomotive propulsion and a number of such units have been built abroad. During the past year the Pennsylvania Railroad placed in service a geared-turbine unit built by Baldwin and Westinghouse (POWER, April 1945, p 95). This marks a definite step forward but faces limitations imposed by difficulty of increasing steam-generating capacity beyond that of this new unit. The Pennsylvania also plans a new unit with two geared-turbine sets.

Turbine-electric drive is also being investigated vigorously. The railroads that compose the Locomotive Development Committee, with three other large Eastern lines, are financing the building of a turbine-electric giant in which a pulverized-coal-fired B & W watertube boiler will supply a turbine and electric drive to be built by GE. The Chesapeake & Ohio has ordered three turbine-electric units in which coal will be carried forward and fired in the largest possible conventional boiler. Steam from this boiler will drive a Westinghouse turbine-electric combination.

Other interesting new steam-powered units have been proposed but none seems able to surmount the thermodynamic obstacle of low cycle efficiency imposed by noncondensing operation. Need for supplying 100% makeup brings with it water problems of serious magnitude. Tremendous firing rates in modern locomotives result in high carryover of unburned carbon and low boiler efficiency at high ratings. Thus, in search for an improved coal-burning locomotive, the committee, after surveying the entire field, has turned to the gas turbine as a probable solution.

The record made by gas turbines since 1936 in Houdry oil-refinery units indicates that the turbine-compressor combination proves entirely satisfactory as far as reliability is concerned. A E Pew, Jr, reported recently (see pp 82-84) that six such units have shown better than 98% availability over a total of more than 25 years' operation, the newest unit having run over 600 days without a turbine interruption. These machines operate at about 900 F, but tremendous wartime advances in metallurgy lead to the conclusion that a gas turbine operating at maximum temperature of 1200 F will be an entirely satisfactory unit.

Gas-turbine-cycle thermal efficiency proves far superior to the conventional noncondensing steam cycle because, using only a single regenerator, an efficiency of 25% can be reached with a 5-to-1-pressure ratio and a temperature of 1200 F. Including electric-drive losses, it is still reasonably safe to assume a minimum over-all efficiency of at least 15%. Thus the gas turbine, even in its present state of development, should be able to begin at a point just beyond the reach of the best possible steam-locomotive-propulsion system. Major turbine manufacturers are confident that, as soon as wartime restrictions are relaxed, they can produce gas-turbine units suitable for locomotives.

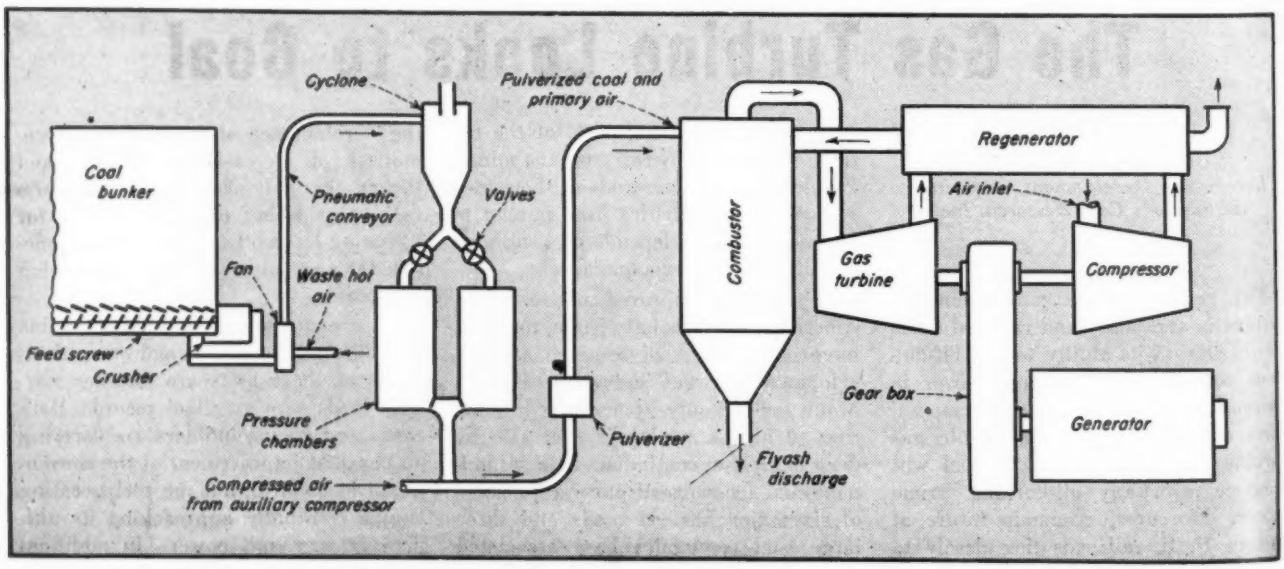
The obvious problem facing a prospective designer of a gas-turbine locomotive is coal combustion in limited space and removal of enough ash from combustion products to insure reasonable turbine-blade life. Three possibilities present themselves. The closed-cycle design as developed by Escher Wyss (see pp 80-81) is suitable for pulverized coal but does not appear to be adapted for railroad use because of space needed for large heat exchangers.

An alternative, already being investigated, is the gasification of coal under pressure and the burning of the resulting gas in the combustion chamber. Major problems to overcome include

Locomotive Development Committee

Chairman:
R B White, president, Baltimore & Ohio Railroad

Members:
C E Newton, president, Chesapeake & Ohio Railway
J B Hill, president, Louisville & Nashville Railroad
G Metzman, president, New York Central System
W J Jenks, president, Norfolk & Western Railway
W S Franklin, vice-president, Pennsylvania Railroad
G M Humphrey, president, M A Hanna Company
J D Francis, president, Island Creek Coal Company
Grant Stauffer, president, Sinclair Coal Company
Howard N Eavenson, president, Bituminous Coal Research, Inc
Harold J Rose, vice-president and director of research, BCR



In proposed plant using coal atomizer, feed screw discharges to crusher. Transfer fan and pneumatic conveyor deliver coal to hoppers so arranged that one fills while the other is valved off and under pressure for supply to pulverizer. Pulverized coal and primary air, under about 60-psi pressure, go to combustion chamber, with which is combined a cyclone for removing flyash. Turbine-compressor set is expected to be of single-shaft design with one regenerator

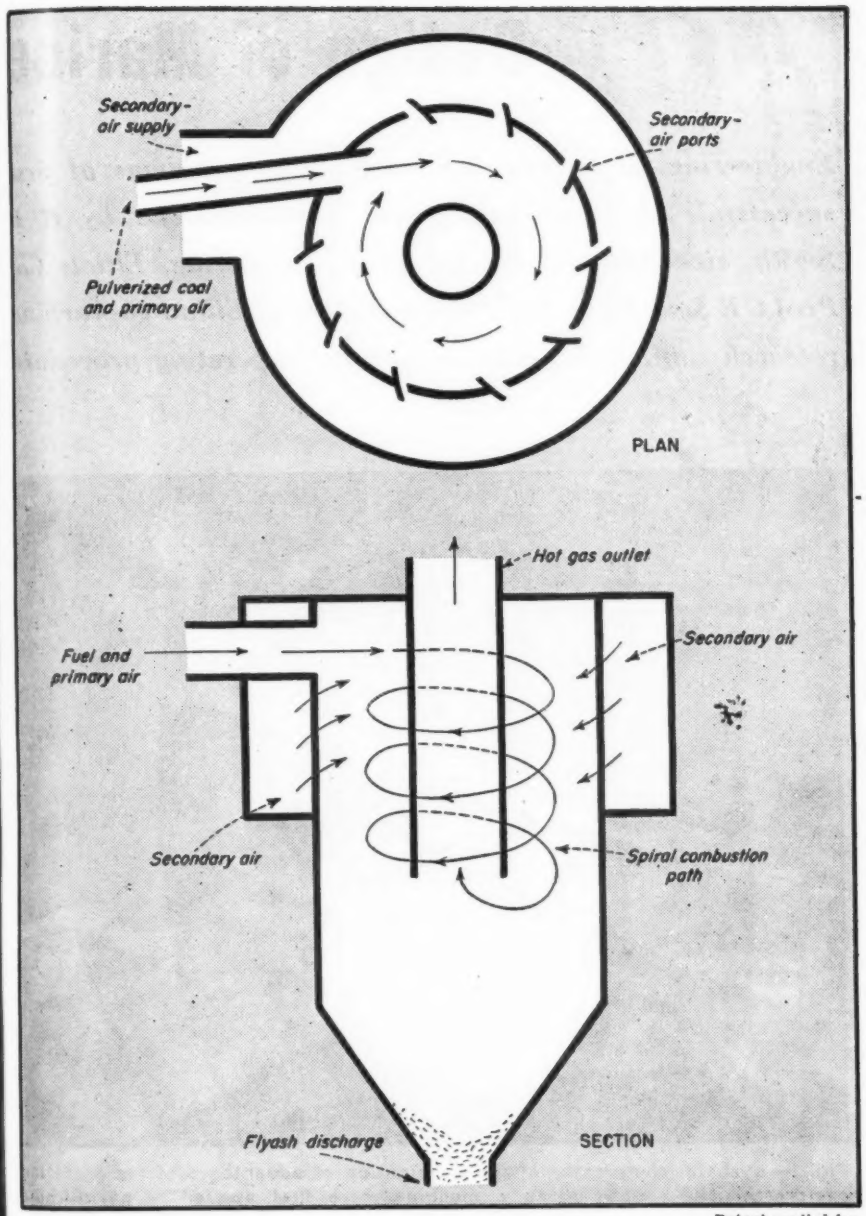


Diagram shows proposal for combining pulverized-coal combustion chamber adapted from British Fuel Research Station's Vortex design with cyclone for removing flyash. Fuel and primary air enter more or less tangentially. Secondary air flows through admission ports around the periphery, moving across fuel in such a way as to cause combustion to follow a spiral path or vortex. High relative velocity of air past fuel particles insures rapid, complete combustion. Flyash particles, except those light enough to follow the gas streamline, drop out at the bottom

Patent applied for

fuel charging and ash removal from a gasification zone which must be under pressure, and cleaning the resulting gas without excessive cooling, which would seriously lower thermal efficiency.

Ultimate goal for coal-fired gas turbines must be direct combustion of fuel and removal of all large particles of ash. The most straightforward solution seems to lie in burning pulverized coal and removing mechanically the maximum possible quantity of flyash. The research program of the Locomotive Development Committee therefore aims at this goal. It will finance and direct a coordinated program in which work at Johns Hopkins University, Battelle Memorial Institute and the Institute of Gas Technology will follow three major lines of attack, studying pulverization, combustion and ash removal.

In addition to various well-known pulverizing methods, the "coal atomizer," developed at the Institute of Gas Technology, will be studied vigorously to learn whether this extremely simple device is adapted to use with compressed air for gas-turbine service. The coal atomizer, to be described in a forthcoming ASME paper, represents a continuous explosion system, which can reduce crushed coal to size suitable for boiler firing by one pass through an apparatus involving no moving parts and weighing only a few pounds.

By subjecting the crushed coal to pressure of a gas such as air or steam and allowing the coal to flow through a nozzle with the gas, an extremely sudden pressure release results that shatters the coal, producing pulverization fine enough for direct firing. Because gas-turbine fuel supply must be under pressure, this device seems particularly well suited to such use. Coal atomizer possibilities will be investigated at Johns Hopkins and the Institute of Gas Technology.

Feasibility of burning pulverized coal under pressure has already been demonstrated and Brown Boveri is known to have under development a direct-fired gas turbine using pulverized coal. However, because little is known of the fundamental principles involved in burning coal under a pressure of about 60 psi, work will be undertaken at Battelle, under direction of Ralph Sherman, on development of a suitable combustion chamber. In addition, the Vortex combustion chamber, developed by the British Fuel Research Station, will be adapted to gas-turbine requirements in an investigation to be carried out at Johns Hopkins, under direction of Dr A G Christie. It has been reported that Vortex combustion chambers have attained a heat liberation of 500,000 Btu per cu ft per hr, using pulverized coal at atmospheric pressure.

Because removal of flyash is an essential requirement for gas-turbine service an attempt will be made to combine the combustion chamber with a cyclone to remove large flyash particles. Extensive work will also be undertaken to determine allowable dust loading for turbine service, both as to maximum particle size and total weight of solids per cu ft of flue gas. Since maximum outlet gas temperature from the combustion chamber will not exceed 1200 F, there should be no question of slag formation. Moreover, with 400% excess air available there will be no smoke from coal-burning gas-turbines.

It is believed that the coal-burning gas turbine is destined to become an extremely important prime mover in the moderate-sized range. It appears so suitable for locomotive requirements that the Locomotive Development Committee will make a direct and vigorous attack upon the problems which must be solved before bituminous coal becomes a standard fuel for gas turbines.

Progress Report on
GAS TURBINES

Design of Marine

Engineering, manufacturing, combustion problems of first successful American-built power unit discussed by R B Smith, vice-president in charge of engineering, Elliott Co, Prof C R Soderberg, MIT, and members of Elliott gas-turbine research staff, with review of starting, operating procedure

► CENTRIFUGAL or axial-flow compressors seriously restrict operation of gas-turbine power plants to a rather narrow range of conditions, particularly with respect to starting and part-load periods. The Lysholm compressor, Fig. 1, a component of the Elliott gas-turbine power unit, is a genuine positive-displacement machine which, for each turn of the shaft, takes in and compresses a fixed volume of air independent of the backpressure imposed. At both intake and exhaust the successive "bites" of air overlap so that a continuous flow is obtained.

Over a very broad range the operating pressure can be independent of air quantity. This has the practical effect of allowing selection of a flow-pressure relationship exactly suited to the associated turbines. Consequently a gas-turbine plant employing positive-displacement compressors has flexibility previously believed unrealizable, along with efficient part-load operation of special significance in stationary-power and marine-propulsion machinery.

Major Elements

Eight major parts comprise the gas-turbine power plant now undergoing extensive performance tests at Jeannette, Pa. Two turbines, two compressors, two combustion chambers and two heat exchangers are assembled to comprise a 2500-hp power unit more efficient than a steam plant of similar capacity.

For full-load operation, air enters the low-pressure compressor, Fig. 2, and is compressed to approximately 43 psia and 300 F. Passing through an intercooler, the air then enters the high-pressure compressor, which raises pressure to about 96 psia, and is heated by the exhaust gas in a tubular regenerator, Fig. 4, before entering the combustion chamber. Fuel oil is burned directly in the air stream to bring temperature to about 1230 F at the entrance to the high-pressure turbine. Expanding in the turbine to 53 psia develops sufficient power to drive the low-pressure compressor.

Additional oil is burned in the low-pressure combustion chamber to reheat to 1207 F. Expansion to a pressure slightly above atmosphere in the low-pressure turbine develops 5000 hp, 2500 hp for the high-pressure compressor and 2500 hp net output. After leaving the regenerator, exhaust gas passes up the stack at about 400 F.

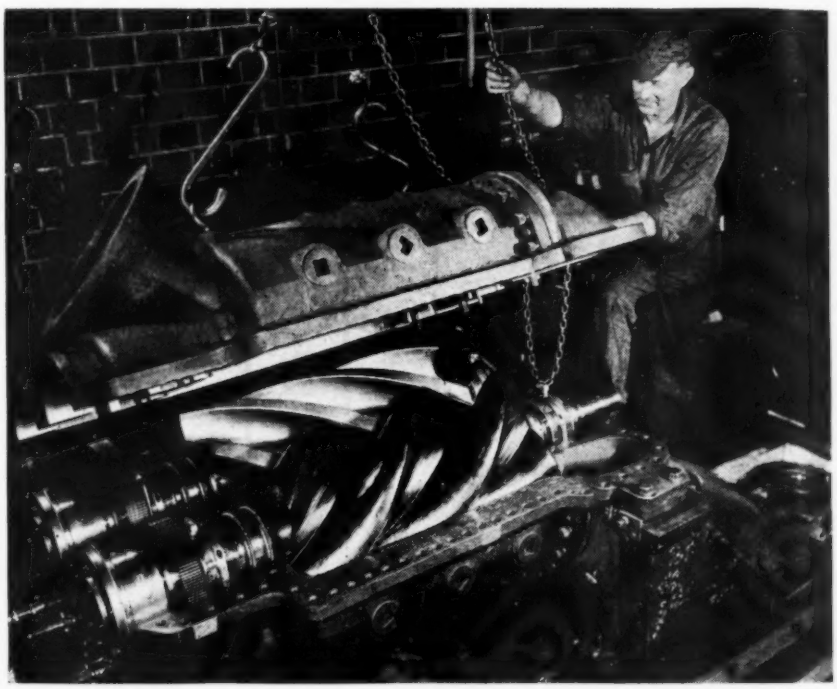


Fig. 1—Lysholm compressor offers combination of advantages of reciprocation compressor and strictly rotating machine, here first applied to gas turbine

Complete control of load is obtained by regulating the fuel flow to the combustion chambers. This, in turn, alters the speed of the turbines and the amount of air entering the system through the positive-displacement compressors in such a way that variation in load takes place at essentially constant temperature at turbine inlets. This type of control is possible only with a compressor that is highly efficient at reduced loads and speeds.

Starting this gas-turbine plant is simple and brief, involving less preparatory work than for a steam plant of comparable size. The starting motor is first engaged, one burner is lighted and the unit warmed up. During this period the operator controls rate of heating by variation of the throttle lever while two crewmen inspect the unit.

When inlet temperature to the high-pressure turbine has been slowly brought up to the point at which the starting motor is to be "dropped," temperature of the low-pressure turbine will also have risen to an acceptable value. Two bypass valves, operated electrically by pushbutton from the main panel, are closed in proper sequence to bring speed of the low-pressure turbine from about 250 rpm maintained during warmup to about 900 rpm.

Raising the starting motor speed (and consequently that of the high-pressure turbine) and increasing fuel combustion rate in proportion to the increased air flow causes the plant to "float" off the starting motor and begin to develop useful power.

A second burner is "lit-off" in the high-pressure combustion chamber re-

Rotary-Compressor Power Unit

sulting in an increase in power developed. Lighting off the low-pressure combustion chamber brings the unit up to full power. It is possible, with both burners in the high-pressure combustion chamber going at full rate and the low-pressure combustion chamber entirely "secured," to obtain an output of 2000 hp.

In a steam plant it is most unwise to go into full-power condition immediately after the warmup period. With the Elliott gas-turbine unit, rate of applying load is less critical since operating temperatures for all loads are approximately the same.

Operating Procedure

One man can control the plant throughout its entire operating range without leaving the control station. There is no need for changing the burners or burner tips to maintain combustion rate commensurate with power developed. In changing load the temperature at turbine inlets is not materially altered. To increase load the operator advances the throttle causing the inlet temperatures to tend to rise. Increase in power developed by this tendency toward higher gas temperature speeds up the unit and simultaneously increases air flow, tending thereby to maintain constant temperature at the turbine inlets.

Stopping Procedure

Shutting down is even simpler than starting. All throttle levers are closed, injection motor is stopped and bypass valves opened. When both shafts slow to about 10 rpm, jacking gears are engaged.

While these operating procedures are seen to be extremely simple, they can only be so as a result of some rather novel engineering and design. Because of the high temperatures at which some of the parts operate, in excess of 1200 F, special alloys, which unfortunately have expansion coefficients 50% greater than ordinary steel, have to be used. Turbines, for example, are nearly a half inch longer when hot than when cold.

Since other parts of the apparatus only a few inches away operate at relatively low temperature, 100 to 300 F, the entire assembly must be quite elastic to provide for expansion. Both high- and low-pressure turbines are solidly mounted at their exhaust ends so that all expansion takes place toward the

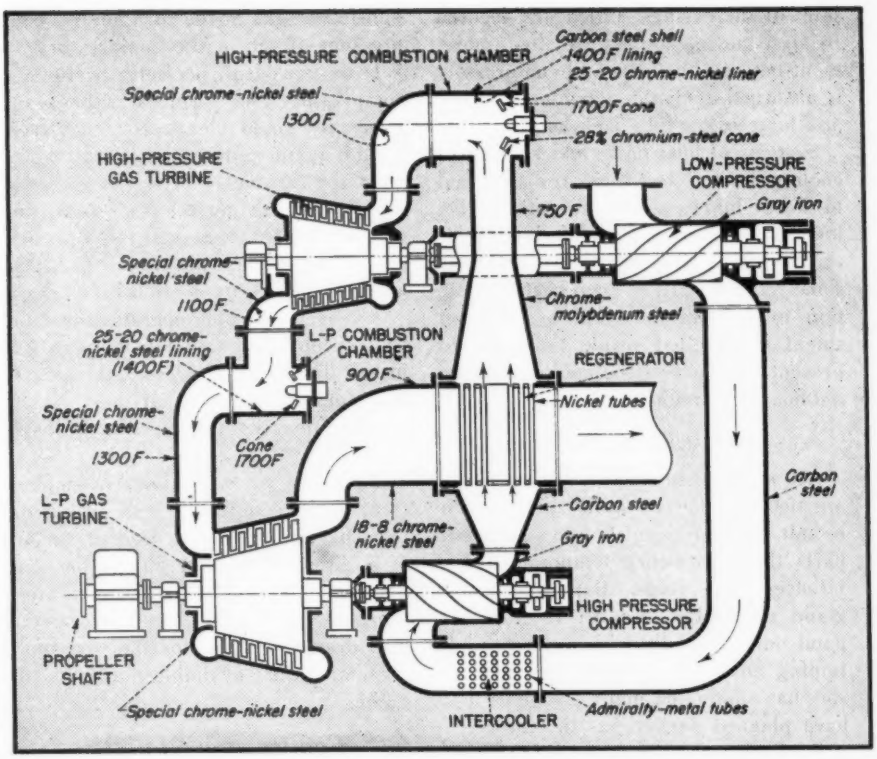


Fig. 2—Arrangement of two turbine-compressor units, combustion chambers and heat exchanger, with indication as to kind of metals used in the construction

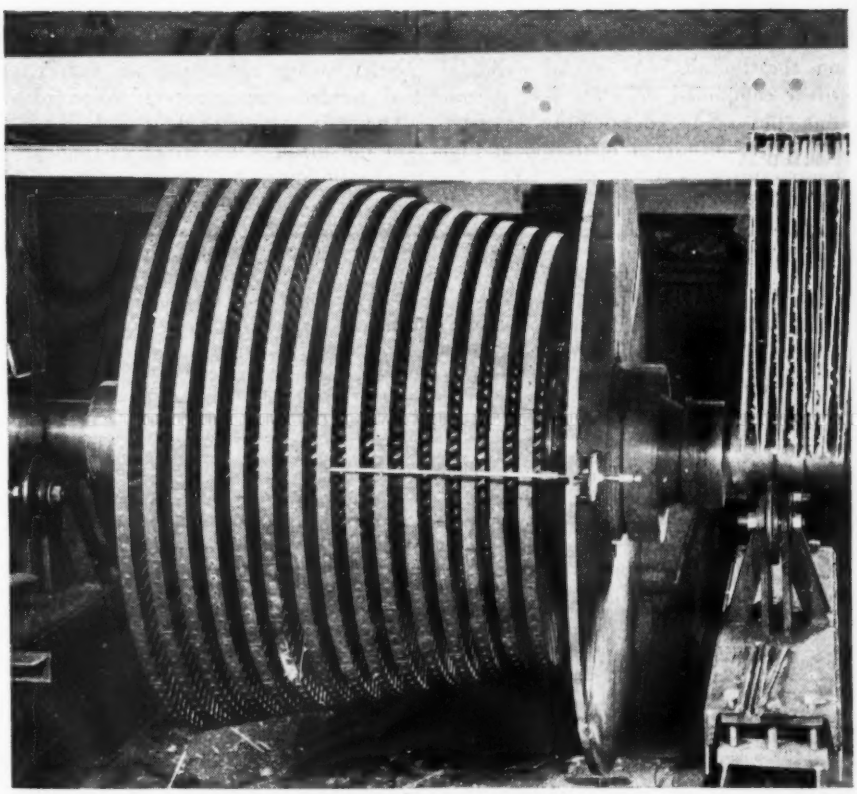


Fig. 3—Gas-turbine rotor set up in frame for welding operation. Individual disks carrying blades were joined to form rotor, which was then heat treated

inlet of the casings, which are secured by free-moving links. Relative movement between turbines and compressors is absorbed by double flexible couplings and long torque-tube jackshafts.

Systems of heat dams and special oil cooling at the bearings are provided to keep lubrication temperatures below 200 F within 10 in. of the 1200-F turbine inlet. Stubshaft ends have reasonably light walls to keep heat conduction to a minimum, and a radiation shield is installed inside the shaft to prevent exposure of the cool end to the red-hot inner regions.

Heat-Elastic Design

All main members of the assembly are tied together by radial pins, which permit free movement between adjacent parts that experience temperature differences. Pin rings, diaphragms and gland assemblies are all free to expand unrestrainedly with respect to adjoining members. This heat-elastic design has eliminated many problems that have plagued earlier gas turbines.

Similarly, the problem of bolting and unbolting the machines involved many engineering problems. The alloy used has the undesirable characteristic of galling when two parts are assembled, necessitating use ot a compound on the threads. A special colloidal-silver compound does the job, permitting the ready disassembly of parts even after sustained operation at high temperatures.

It would be logical to ask why the gas turbine must run so hot. The answer in simple words is that the output power is determined by the difference in temperature level between expansion of gas in the turbine and compression of air in the compressors.

If we had ideal, perfectly frictionless compressors and turbines without any losses we could compress air and expand it again, getting just enough power from the turbine to drive the compressor. With such perfect machinery, any increase in temperature of compressed gas before expansion would result in a proportional output of useful work.

A real gas turbine operates the same way except that actual machinery has losses. The larger the losses, the greater the temperature rise that must be devoted to making the machine self-sustaining.

The more we can raise the temperature of the compressed gas before expansion, the more work we can get out of a given rate of air circulation, and the higher the plant efficiency, other things being equal. Thus the gas-turbine designer strives for the very highest temperature available materials can stand.

Construction Materials

As can be seen from Fig. 2, special materials play an important part in making operation possible under the extremely high temperatures involved. Duct work, combustion chambers and outer casings of turbines are fabricated of welded stainless-steel rolled plate. The main stationary structural elements of the turbines are alloy castings.

In building the turbine rotors, disks are completely machined from alloy rolled plate, blades attached and shrouds placed prior to assembling the rotor. One forged alloy stubshaft is then set up in a framework and the first disk heated in hot water and placed on it for shrink fit. After succeeding disks and second stubshaft are shrunk on, the disks are tackwelded and the shaft supported in a horizontal position for final welding. Fig. 3 shows one rotor set up in a frame for rotation at welding speed by a variable-speed drive. Guards between disks protect the blades and the disks from weld spatter.

The rotors are then heated to 1400 F for 16 hours as a heat treatment. After semi-final machining rotors are returned to the furnace for heat indication, that is, balancing after the material has become stable at the operating temperature.

Compressor Shafts

Shafts for the large rotors of the Lysholm compressors must, of course, be steel. However, steel is not a good material for the rotors themselves. This sets up a problem of attaching steel stubshafts to the cast-iron rotors. After much experimenting, low-temperature furnace brazing (silver soldering) was adopted with a special method of cleaning and fluxing the material and a heating cycle set up that assured good silver-brazed joints between stubshafts and rotors.

The regenerator contains 8½ miles of nickel tubing, the largest order ever supplied. Fins of sheet nickel had to be joined to the tubes by some means that would remain strong at 1000 F yet transmit heat readily. After much testing and numerous changes a method was developed using a copper-brazing process.

Major Differences

While a complete description of each of the many components and their construction is impracticable here, it should be noted that turbines, compressors, regenerators and combustion chambers are all materially different from what would be considered normal steam or power practice. Their assembly into a workable, efficient prime mover represents a long forward step toward practical gas-turbine power plants for industrial, locomotive, refinery and marine applications comprised of the essential elements built into this first unit.

There are many combinations possible, ranging from the simplest single-shaft machine to multi-turbine-compressor units with several combustion chambers and intercoolers. Relative complex-

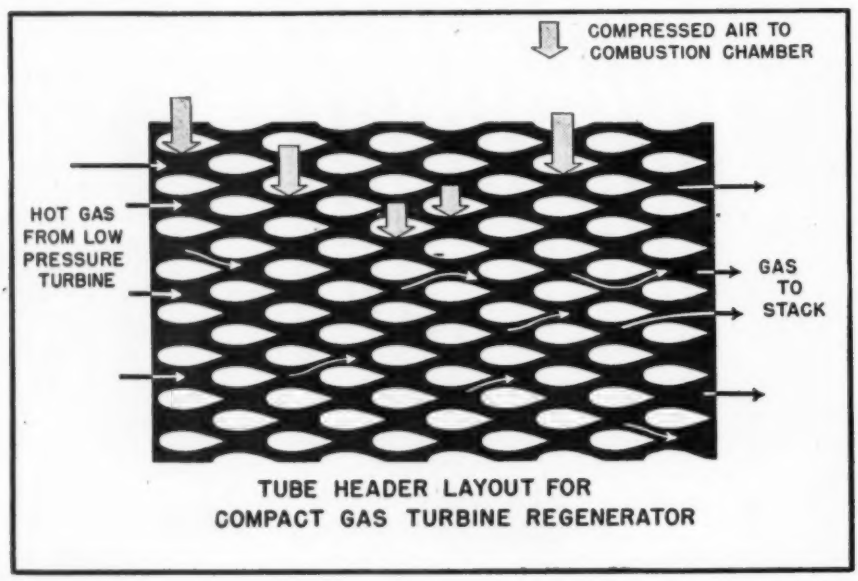


Fig. 4—Heat exchanger or regenerator made up of streamlined nickel tubes designed for compactness and minimum pressure drop of both circulating fluids

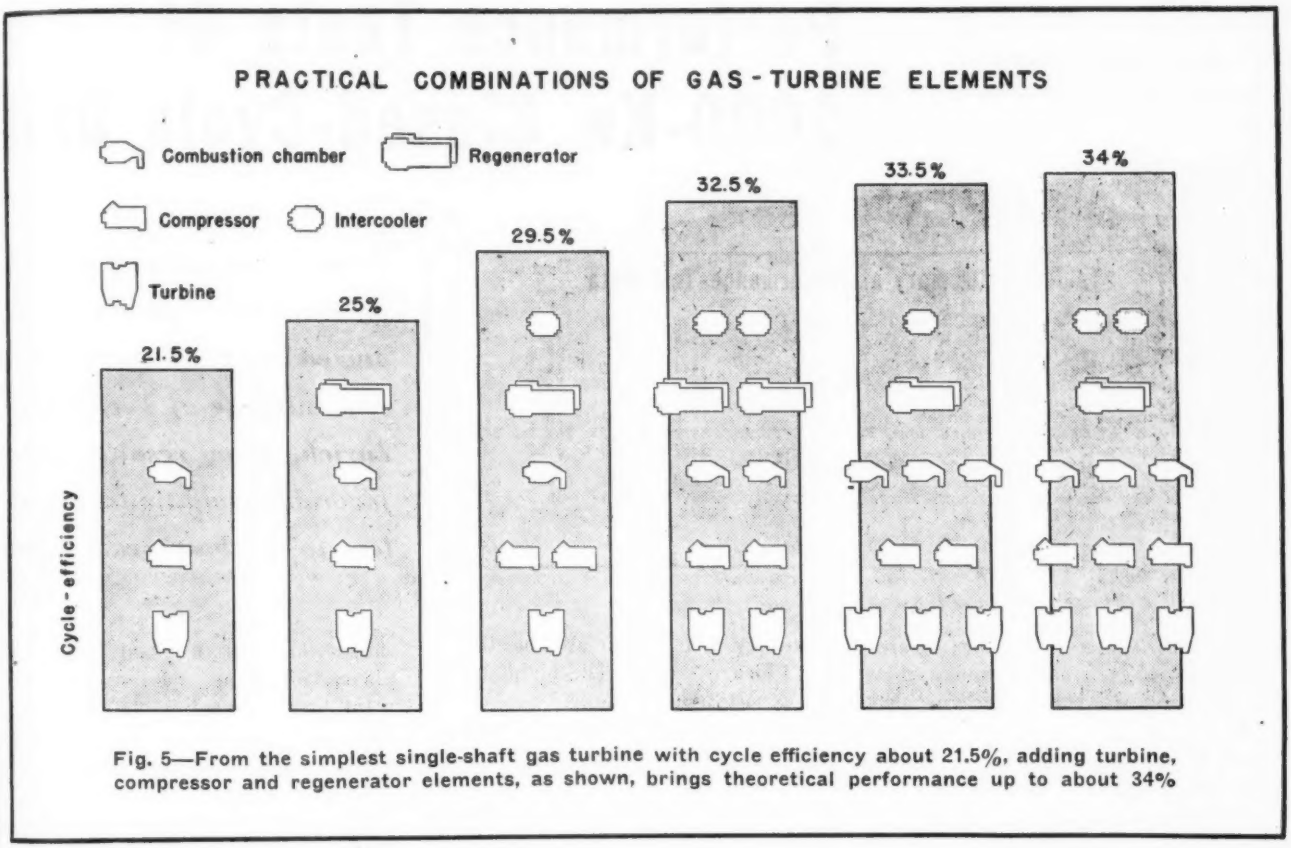


Fig. 5—From the simplest single-shaft gas turbine with cycle efficiency about 21.5%, adding turbine, compressor and regenerator elements, as shown, brings theoretical performance up to about 34%

ity and efficiency of several practical arrangements are indicated in Fig. 5.

The regenerator has the greatest single effect on raising efficiency, but 2-stage compression with intercooling likewise produces a considerable gain. Additional intercooling and reheat result in progressively smaller increases in cycle efficiency. However, as the number of elements are increased, they become reduced in size and are consequently easier to build.

This first gas turbine of Elliott design was selected as a 2-compressor 2-turbine, 2-combustion-chamber unit, which has as high efficiency as possible without too great complication. It is designed to fire high-grade fuel oil to minimize difficulties anticipated for the high combustion rates in the fuel chambers under conditions of wide range of control necessary for a marine propulsion unit.

Combustion Experience

Some experience has already been gained in firing an experimental combustion chamber with No. 5 fuel oil. While combustion is not quite as clear as with lighter oil, no great difficulty has been encountered. Burning coal involves difficulties of sizable proportions.

Combustion chambers for pulverized coal must certainly be larger than those of the oil-fired type, but a combination of increased air pressure and the new principle of suspension firing applied in this gas turbine for oil may result in relatively high ratings for coal-fired combustion chambers. Ash and other impurities must either be precipitated ahead of the turbine or carried through it. The ash, however, will be dry at any temperature at which gas turbines are likely to operate in the near future, eliminating danger of slag deposits. There is a possibility that difficulties from blade erosion may be much less than heretofore anticipated.

Just how great these difficulties may be and how to eliminate them is obviously a matter for further development. The great economic advantages inherent in coal firing provide every incentive for pushing this work with all available resources.

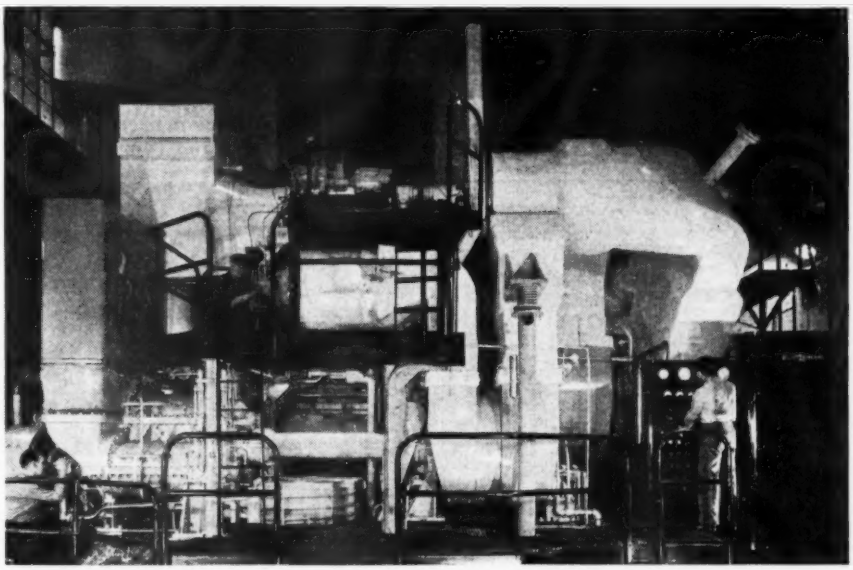


Fig. 6—Shop view of complete power unit with low-pressure compressor and high-pressure turbine in foreground, high-pressure combustion chamber above

Progress Report on
GAS TURBINES

Performance Tests Of 2000-Kw Closed-Cycle Unit

Tests on experimental high-pressure-air turbine, conducted by Prof Quiby, Federal Institute of Technology, Zurich, show results, under favorable conditions, equivalent to the best steam plants

Table I—Summary of Performance-Test Data

Load, approximate percent of full load	20	50	75	100
Generator output at terminals, kw	418	967	1591	2044
Generator efficiency according to SEV, %	93.7	96.3	96.8	96.7
Output at coupling according to SEV, kw	446	1005	1644	2111
Total power requirements of auxiliaries, kw	18.9	31.2	53.1	75.1
Net output measured at terminals, kw	399.1	935.8	1537 9	1968.9
Temperature at high-pressure-turbine inlet, F	1288	1279	1276	1268
Pressure at high-pressure-turbine inlet, F	83.8	168.2	267.7	343.0
Total pressure ratio of turbines	3.57	3.56	3.56	3.57
Specific fuel consumption based on net output*, lb. per kwhr.	0.820	0.658	0.633	0.614
Thermal efficiency, including auxiliaries, %	24.4	29.5	30.5	31.6
Net heat rate, Btu per kwhr	13,960	11,560	11,190	10,790

*Lower heating value of fuel is 18,450 Btu per lb

▶ PERFORMANCE DATA on the Ackeret-Keller closed-cycle aerodynamic-turbine power plant have been eagerly awaited. Part of the desired information was made available by Escher Wyss Engineering Works, Ltd, of Zurich, in a statement submitted to the Gas Turbine Coordinating Committee of the Oil and Gas Power Division, ASME, and presented by R T Sawyer at a meeting of the Chicago section. The highlights of the report follow:

Construction of a test plant of commercial size, 2000 kw, began in 1936; the design emphasized suitability for experiment and development rather than compactness of layout and pleasing appearance. Photo at top of p 73 shows the over-all plant. For simplicity, oil firing was adopted. The plant first operated in the summer of 1939 and ran from the beginning without fundamental difficulties. Official tests were conducted by Prof Quiby, Federal Institute of Technology, Zurich, on Dec 13 and 14, 1944.

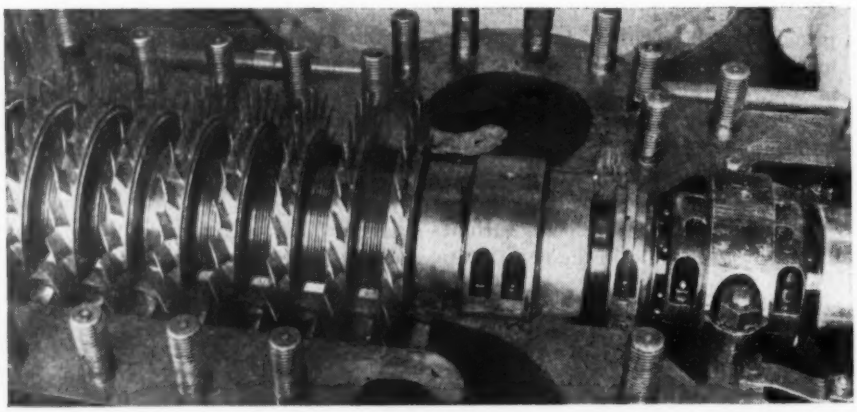


Fig. 1—Axial compressor has three rotors like the one shown here with upper half of casing removed. All are less than 14 in. diameter and run at 8000 rpm

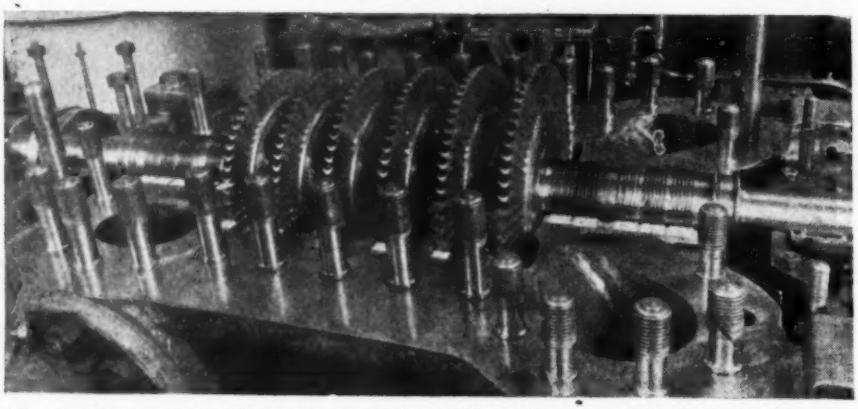


Fig. 2—Closeup of high-pressure turbine with casing removed. The unit has six stages and full air admission (1200 F and 340 psia) without governing valves

Referring to the heat-balance diagram, Fig. 4, it can be seen that the working fluid is air, which circulates in a closed cycle. Although compression ratio is approximately four, about the same as for an open-cycle unit, pressures in the cycle range from 85 to 343 psia. These higher pressures, made possible by closing the cycle, permit smaller parts because of the denser working medium. However, closing the cycle requires the equivalent of a steam-plant condenser in the form of an air cooler to bring the working fluid back to starting conditions at compressor inlet.

Axial-Flow Compressor

The axial-flow compressor consists of three casings, Fig. 1, with intercoolers to bring air back to initial temperature. High-pressure air goes from compressor outlet to a heat exchanger where hot air from turbine exhaust raises its temperature before it enters the oil-fired air heater. Here temperature is raised to 1200-1300 F before passing to the turbine.

The high-pressure turbine drives the 8000-rpm compressor while a low-pressure section drives a 3000-rpm generator. Of total turbine output, 60% goes to the compressor and 40% to the generator. Exhaust from the low-pressure turbine, at about 750 F, goes through the heat exchanger, giving up

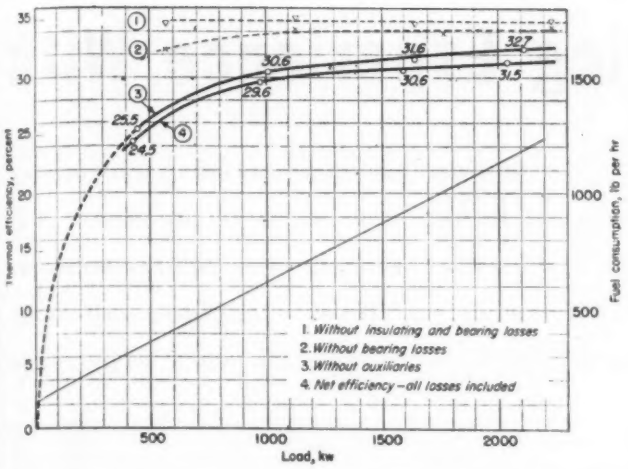


Fig. 3—Thermal efficiency of over-all plant as determined by tests of Dec 13, 1944. Curves indicate effect of bearing and insulation losses and power needed for auxiliaries

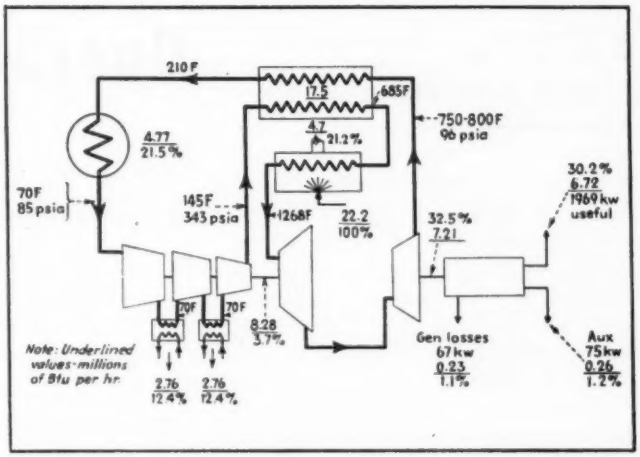


Fig. 4—Estimated heat balance worked out by POWER editors (from incomplete data) indicates general order of magnitude and distribution of stack and cooling-water losses

heat to air from compressor discharge, and then passes to a cooler in which circulating water removes sufficient heat to bring air from about 210 F down to 70 F for admission to the compressor and repetition of the cycle.

Interesting construction marks the pipes connecting the oil-fired air heater and the turbine. A thin-walled inner tube capable of resisting high temperatures serves only to guide the hot air; small holes toward the insulating space between this tube and an outer one, relieve the inner tube of pressure. The outer tube, protected by insulation from the inner, is of standard metal, thick enough to withstand the pressure of 343 psia. This construction reduces amount of temperature-resistant material required. Working air enters the high-pressure turbine symmetrically through two supply pipes and all stages have full admission. Labyrinth glands and sealing air prevent loss of working fluid.

Fig. 5 shows a design of air heater for pulverized-coal firing in which ash can be removed in a liquid or dry state. Recirculating flue gas into the heating chamber reduces temperature sufficiently to operate air-heater tubes without special cooling. Flue gas from combustion chamber again passes through the heating chamber countercurrent to the working air. In spite of high working-air velocity inside the tubes, special layouts permit holding pressure losses down.

Regulation of this power plant is effected by a bypass valve, which changes amount of working fluid circulated. The machines have no valves, at either inlet or outlet, and pressure ratio and temperature remain essentially constant. This permits a more or less flat efficiency curve.

Table I and Fig. 3 summarize available test data and Fig. 4 is an estimated heat balance prepared by POWER editors from this incomplete data. By its very nature it cannot be more than indicative of the general order of magnitude and distribution of heat losses. In evaluating test results, due allowance should be made for the fact that efficiencies are reported on a lower-heating-value basis, standard European practice, and that the date of the tests indicates the availability of very cold circulating water, favorable to high efficiency.

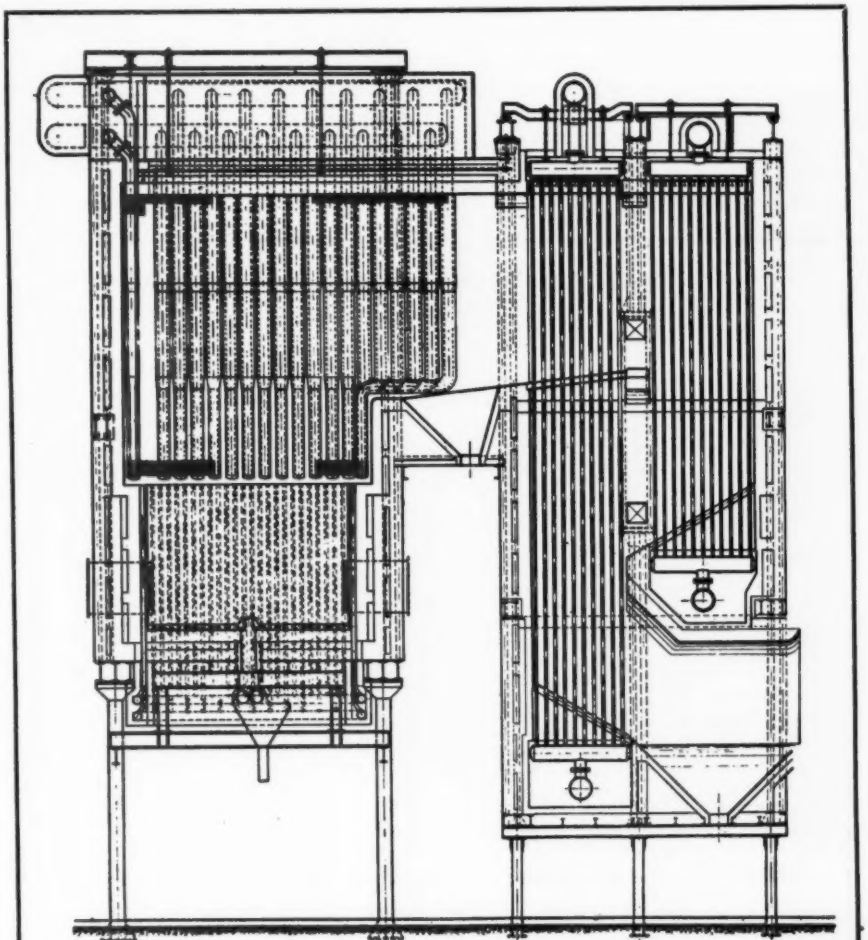


Fig. 5—Air-heater design for pulverized-coal firing includes provision for recycling flue gas to reduce furnace temperature to desired level

Progress Report on
GAS TURBINES

Operating Experience With

First published information on commercial performance shows reliability equal to best steam-turbine practice. A E Pew, Jr, Sun Oil Co, presents comprehensive figures on operation and maintenance of six Houdry turbine-compressor sets representing a total of more than 25 years' experience

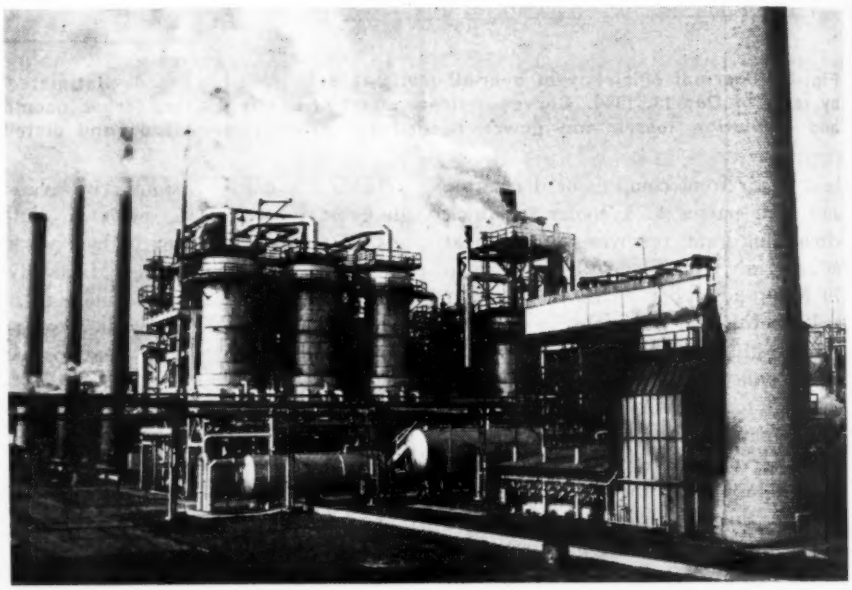


Fig. 1—Typical Houdry static-bed catalytic-cracking unit in a Sun refinery

► FIRST SUCCESSFUL LARGE GAS-TURBINE set in the U. S. was installed in 1936 at the Marcus Hook, Pa., refinery of the Sun Oil Co, as part of a Houdry catalytic cracking unit. Since that time, Sun has put in operation six additional sets and a total of 26 have been installed in various U. S. Houdry-process units. To date, this represents the major commercial application of gas turbines and the largest body of experience under routine operating conditions. Thus data on the performance of these units have been eagerly awaited. In a paper sponsored by the Oil and Gas Power, Process Industries, and Power Divisions, ASME, and presented before the Chicago section, A E Pew, Jr, vice-president in charge of manufacturing, reported on Sun Oil Co's experience, concluding that the installations have proved eminently satisfactory.

A Houdry catalytic cracking unit, having a capacity of about 10,000 bbl per day of high-octane gasoline, requires about 40,000 cfm of 45-psi air for regenerating the catalyst. Oxidation of carbon desposits on the catalyst by this air releases sufficient heat energy to permit driving a gas turbine with the combustion products, the turbine output being more than enough to drive the axial-flow compressor supplying the regenerating air. Excess turbine output is recovered as electrical energy. In the usual installation, gas temperature at turbine inlet ranges from 875 to 950 F, with exhaust at about 550 F. Inlet turbine pressure is about 40 psig and compressor outlet pressure is about 50 psig. Catalyst cases are so arranged that the intermittent regeneration cycle produces a steady flow of combustion products for the turbine.

Table I lists the gas-turbine-compressor installations in service on static-bed Houdry units and Table II summarizes operation of six of the seven units operated by Sun Oil Co. The seventh unit, at Toledo, was not included, Mr Pew explained, because operating records at this small refinery are not sufficiently complete. However, the general performance of the machine has been entirely satisfactory. A typical Sun Oil Co 40,000-cfm installation comprises a 6200-hp 950-F 5-reaction-stage gas turbine, a 20-stage axial-flow compressor, a governor and oil pump, auxiliary oil pump, 3 and 10% overspeed

Table I—Gas-Turbine Compressors in Service On Static-Bed Houdry Units

Company	Location	No.	Nominal rating, cfm	Manufacturer
Sun (11–4)	Marcus Hook, Pa	1	40,000	Brown-Boveri
Magnolia	Beaumont No. 1, Texas	1	23,000	" "
Sun (12–3)	Marcus Hook, Pa	1	40,000	" "
Socony	Trenton, Mich	1	23,000	Allis-Chalmers
Socony	Brooklyn, N. Y	1	23,000	" "
Sun	Toledo, Ohio	1	40,000	" "
Magnolia	Beaumont No. 2, Texas	1	40,000	" "
Socony	Buffalo, N. Y	1	23,000	Brown-Boveri
Socony	E. St. Louis, Ill	1	23,000	" "
Socony	Augusta, Kansas	1	23,000	Allis-Chalmers
Socony	Paulsboro, N. J	1	23,000	Brown-Boveri
Sun (12–3 Ref)	Marcus Hook, Pa	1	*23,000	Allis-Chalmers
Sun (10–3)	Marcus Hook, Pa	2	40,000	" "
Tide Water	Bayonne, N. J	1	60,000	" "
Socony	E. Chicago, Ind	1	23,000	" "
Std Oil Calif	El Segundo, Calif	1	40,000	" "
Gulf Oil Corp	Port Arthur, Texas	1	40,000	" "
Sun (15–1)	Marcus Hook, Pa	1	40,000	" "
Sinclair Ref	Houston, Texas	1	40,000	" "
Magnolia	Beaumont No. 3, 4	2	23,000	" "
Sinclair Ref	Corpus Christi, Texas	1	40,000	" "
Southport, Pet	Texas City, Texas	1	40,000	" "
Std Oil Ohio	Cleveland, Ohio	1	40,000	" "
Std Oil Ohio	Cleveland, Ohio	1	23,000	" "

** 23,000 cfm casing with blades cut for 16,000 cfm output.*

SUMMARY: One 60,000-cfm unit, thirteen 40,000-cfm units, twelve 23,000-cfm units Total units. 26

NOTES: Units are of same general design, taking suction at atmospheric pressure (based on 60 F) and discharging at 45 psig. Turbine throttle conditions are 40 psig and 800 to 950 F. Gas flow through turbine of 40,000-cfm unit is 3170 lb per min. All operate at 5180 rpm. Weight of 40,000-cfm set is about 70,000 lb.

Gas Turbines in Refinery Service

valves, oil coolers and filters, a 1500-hp generator, a starting motor or steam turbine, and reduction gears between compressor and generator, and between generator and starting unit. Turbine and compressor are direct connected.

Materials used in principal parts of turbine-compressor units are: 18-8 chrome-nickel steel (originally nickel) for sealing strips, stainless steel for turbine blades, nickel steel for compressor blades, forged chrome-nickel steel for turbine spindle, cast molybdenum steel for turbine casing, forged steel for compressor spindle, cast iron for compressor cylinder and bedplate.

In starting up, the starting motor or steam turbine rotates the unit at about 2000 rpm for several hours while bearings warm up and equipment is checked. During this period, air from the compressor flows through a bypass to the turbine. When 25 to 30% of normal speed is reached and unit completely checked, a pressure burner preceding the turbine brings up temperature. Bringing unit up to full speed, 5180 rpm, over a period of 8 to 10 minutes, increases pressure and air volume circulated. An air heater on the discharge side of the compressor gradually raises temperature of air from compressor outlet. This heated air is admitted to the catalyst cases and regeneration begins. The resulting products of combustion supply energy for gas-turbine operation and the pressure burner used in starting is shut off.

Excess Turbine Power

Under normal operating conditions amount of excess power delivered by the turbine to the generator depends on the type of catalytic cracking reaction. With increase in carbon deposition, power increases. In general, with air temperature of 60 F at compressor inlet and with gas temperature of 950 F at turbine inlet, a 40,000-cfm unit will generate up to 900 kw in excess of the power required to drive the compressor.

Table II shows number of operating days on each of six Sun Oil installations and days shut down because of turbine-compressor difficulties. Under the heading "days off, turbine trouble," is included time chargeable to the complete turbine-compressor unit and necessary auxiliary equipment. The operating division of Sun Oil Co believes that time lost because of turbine troubles has not been excessive under the conditions encountered.

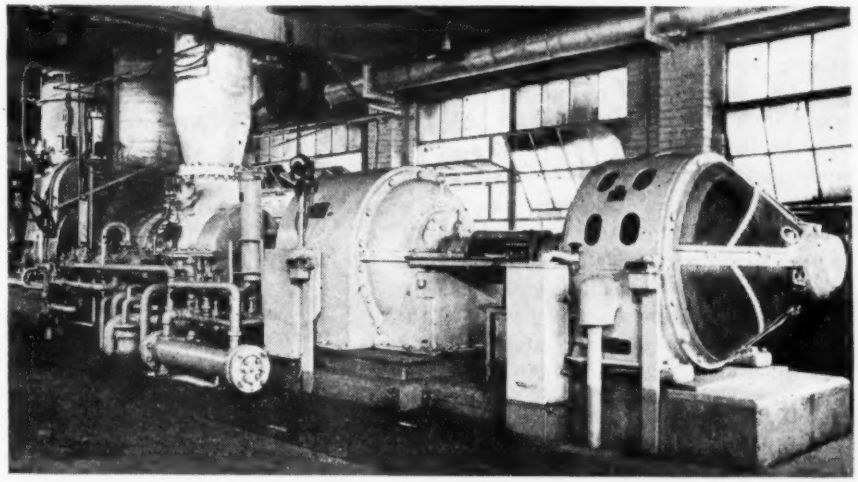


Fig. 2—40,000-cfm gas-turbine compressor set in Sun refinery. Starting motor is at right, with generator next, then compressor and gas turbine at far left

Table II—Operating Experience of Sun Turbine-Compressors

Location	*Capacity, cfm*	*Starting means*	*Date in service*	*Operating days*	*Days off, turbine trouble*	*Total days*	*Outage, percent*
Marcus Hook (11–4)	40,000	Motor	12/36	2607	50	2657	1.88
Marcus Hook (12–3C)	40,000	Motor	7/39	1900	21	1921	1.09
Toledo (3)	40,000	Motor	8/39	(No complete operating data)			
Marcus Hook (12–3R)	16,000	Turbine	11/40	1413	45	1458	3.10
Marcus Hook (10–3N)	40,000	Turbine	12/40	1404	34	1438	2.36
Marcus Hook (10–3S)	40,000	Turbine	1/41	1365	29	1394	2.08
Marcus Hook (15–1S)	40,000	Turbine	8/43	569	0	569	0.00

NOTES: All units operate at 5180 rpm and compressors discharge at 45 psig. Except 16,000-cfm unit, which has a 500-hp generator, all units drive 1500-hp synchronous generators. Most recent unit was originally equipped with Kingsbury thrust bearing, all others with angular-contact ball bearings, which have since been replaced with Kingsbury bearings. Data complete to May 31, 1945.

Table III lists causes of failure in order of prevalence and Table IV summarizes the number of failures of each type and the total time lost for each. Bearing trouble accounted for 29 out of 46 failures and 101 days out of a total of 179 lost from all causes. It was early found that the angular-contact ball bearing was not satisfactory for the thrust conditions met and these bearings have been replaced with Kingsbury thrust bearings. There have been no thrust-bearing failures or repairs since Kingsbury units were installed, the first having operated satisfactorily since June 1942. In view of the record it is believed this type of thrust bearing is well suited to these gas-turbine compressors and it is a fair assumption that had Kingsbury units been used from the beginning, total time lost would have been about 60% less.

Six lubrication failures caused a loss of 28 days, as shown in Tables III and IV. Installation of blotter presses seems to have overcome these difficulties and there have been no such failures since.

Blade failures in compressor and turbine caused four shutdowns totaling 19 days. These failures resulted from loosening of blades; a later design of blade with an integral root has given no trouble in over 22 months' operation in a Sun unit. Some erosion of gas-turbine blades has resulted from fine particles of catalyst present in the gas or small deposits of carbon dust. The erosion noted has not been sufficient to create an important problem but experimental work is being done to eliminate it by trapping air entrances to the turbine.

The tables indicate one 3-day shutdown resulting from air-seal failure. Sealing strips gradually wear out from rubbing caused by changes in alignment. These may be repaired during

a normal shutdown and are not considered as a weak spot which might necessarily cause shutdowns. However, improvements in air seals grow more important as shutdowns for other causes are eliminated.

Explosions caused three shutdowns, totaling twelve days' lost time. These are not due to turbine design but result from errors in operation or failures in handling other parts of the equipment serviced by the turbines. None of the three explosions was of sufficient severity to rupture the equipment. Miscellaneous failures, mostly due to errors in maintenance, accounted for 16 days' lost time.

In summary, bearing, lubrication and blading failures represented three major causes of shutdown and accounted for 148 lost days out of a total of 179. It is believed that changes described have satisfactorily and substantially eliminated these causes of outages.

Cost of maintenance and repairs of units listed ranged from a high of about $1000 a month to a low of $300. The most costly repair is gas-turbine reblading. Under present conditions it is estimated at $13,000, of which about $12,000 is for blades. Cost of cleaning the units has averaged about $300 per year. Cost of maintenance and repairs on units of present design may be estimated conservatively as 3% of capital investment per year.

Reviewing the important considerations involved in installation of gas-turbine units, Mr Pew stressed the need for ample provision in piping layout to reduce strains to a minimum. Piping to turbine and compressor is unusually large; on a 40,000-cfm machine compressor inlet is 36 in. and outlet 30, while on the gas turbine inlet is 30 in. and outlet 36. Expansion and contraction of the turbine piping, which operates at high temperatures, must be fully compensated for because the alignment of the light high-speed machine must be maintained accurately.

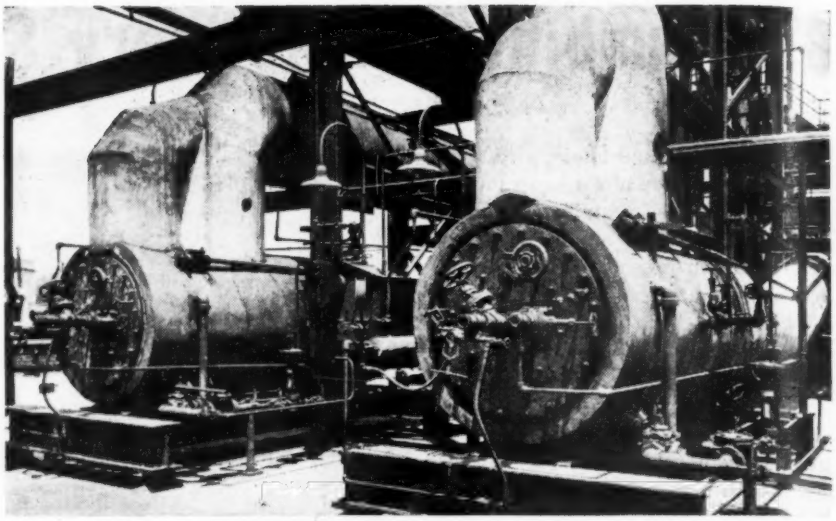


Fig. 3—Combustion chambers for Houdry unit; one for starting, one for normal operation. Divided pipe entering at top carries air from compressor outlet; lines from ends of chambers carry combustion products to turbine and catalyst cases

Design of burners used for starting the turbine also requires careful consideration. Air at approximately 350 F and 45 psig from the compressor outlet enters the combustion chamber through a 30-in. pipe, air flow being divided so that part passes through the air register to the oil burner for combustion, and the remainder passes through a control damper and around the outside of a 30-in. chrome-nickel shell inserted in the 42-in. steel-pipe combustion chamber. The inner shell has perforations so arranged that air infiltrates into the inner shell, causing swirling and mixing, and cooling the shell walls. Products of combustion and excess air mingle at the end of the 42-in. combustion-chamber section and pass to the catalyst cases. Mixture temperature runs about 950 F and temperature within inner shell is approximately 2000 F. No refractory material is used. Burners of this type have operated for a number of years with entirely satisfactory results.

Table III—Failures Causing Turbine Outage, In Order of Prevalence

1. **BEARINGS:** Thrust bearings—spring rings of roller bearings—1500-hp generator bearings.

2. **LUBRICATION:** Dirt in oil sprays causing bearing failures—water in oil (condensate) causing bearing failures—main oil pumps (broken shaft spline resulting from bearing failures)—auxiliary oil pump (failure to start when main pump failed)

3. **BLADES:** Loose blades (latest design with integral root shows no loose blades in 22 months on one unit)—erosion of blades in gas turbine

4. **AIR-SEAL STRIPS:** Rubbing resulting from change in alignment—expansion joints. Note: Failure of seal strips does not necessarily cause shutdown

5. **EXPLOSIONS:** Bypassing air into oil vapors, experimental case (11-4)—air bypassed into oil vapors on 12-3 reformer—gas burner opened by mistake on 12-3 case—dirty oil burner (no atomization) on 10-3 unit

6. **MISCELLANEOUS:** Foreign objects in compressor or turbine—failure to synchronize before cutting motor in when starting unit

Table IV—Summary of Failures Causing Turbine Outage

Cause	*Outages*	*11=4*	*12=3C*	*12=3R*	*10=3N*	*10=3S*	*15=1*	*Total*
Bearings	Number	18	4	4	3	..	..	29
	Days	43	12	31	15	..	..	101
Lubrication	Number	..	..	3	3	..	..	6
	Days	..	..	14	14	..	..	28
Blades	Number	..	1	..	..	3	..	4
	Days	..	4	..	..	15	..	19
Air seals	Number	..	1	..	..	..	..	1
	Days	..	3	..	..	..	..	3
Explosions	Number	1	1	..	1	..	..	3
	Days	5	2	..	5	..	..	12
Miscellaneous	Number	1	..	..	..	2	..	3
	Days	2	..	..	..	14	..	16
Total	Number	20	7	7	7	5	0	46
	Days	50	21	45	34	29	0	179

Match the Lifting Sling to the Load

Designing and building a derrick or crane accurately does not guarantee that within-capacity loads will be handled safely. Just as important is the sling, W E Rossnagel says. To avoid accidents it must lift the load with a fair margin of safety

▶ EVEN THOUGH a design engineer gives close attention to choice and installation of the component parts of hoisting tackle on a crane or derrick, including cables and attachments, sheaves, pins, blocks and hooks, nevertheless, his efforts may be largely nullified if riggers use improper slings or handle proper slings incorrectly.

Fiber rope and chains of iron and steel have been largely superseded by steel-wire rope for hoisting tackle on such equipment, with increased safety and the ability to lift much greater loads. Fiber rope and chain both have their proper places on rigging jobs. The former is used for lifting comparatively light loads and on temporary work, while the latter have been universally adopted for infrequent service and light loads as, for example, on the familiar chain hoist.

But on permanent installations and in heavy-duty operations, both fiber rope and chain have limitations. Fiber rope deteriorates rapidly when exposed to the weather, and afterwards it is difficult to estimate its actual strength. While chain has much greater resistance to exposure to the elements, it has other shortcomings. For instance, the human factor is ever present since the welder may or may not have made a perfect weld. Electrically welded steel chain is considerably more uniform in quality, but even its safety depends upon the proverbial *weakest link* because failure of any one link causes a load to drop.

Wire hoisting rope, on the other hand, is usually 6x19 Warrington construction, consisting of six strands each containing 19 wires, twisted or laid around a hemp-rope center. Unlike the chain, failure of a single element (one wire) reduces strength less than one percent. This is the primary reason why wire rope has been almost universally adopted for cranes and derricks.

Just as with hoisting tackle, various materials may be used for lifting slings. For lightest loads an endless fiber rope, looped into a noose around the object to be lifted, is satisfactory. Such a sling is inexpensive, light, flexible and easy to handle. It can be bent around the comparatively sharp edges of boxes or crates, but should be padded where it passes over sharp edges of metal parts. Even on certain heavier jobs, such as handling shafts that must not be scratched or burred, fiber-rope slings find favor.

Coil chains have a limited application as slings, being used principally for light loads or where exposed to heat, as in foundries. Like fiber rope, a chain should be heavily padded where it bears on sharp edges of metal parts; otherwise, some of the links may be subjected to severe bending stress for which they are not designed. Also the chain may bruise or otherwise damage the edges of the piece being lifted.

Special Slings

For special work, slings are sometimes made of roller chains, leather, cotton webbing and such materials, but today by far the greatest number are of wire rope with the same points of superiority as wire ropes for hoisting tackle. But even wire-rope slings must be carefully chosen for the service they are to perform because they also have limitations. Like fiber-rope and chain slings they should be padded where bent over sharp edges of an object to be lifted. Even though the edge is of soft material, such as a wood crate or skid

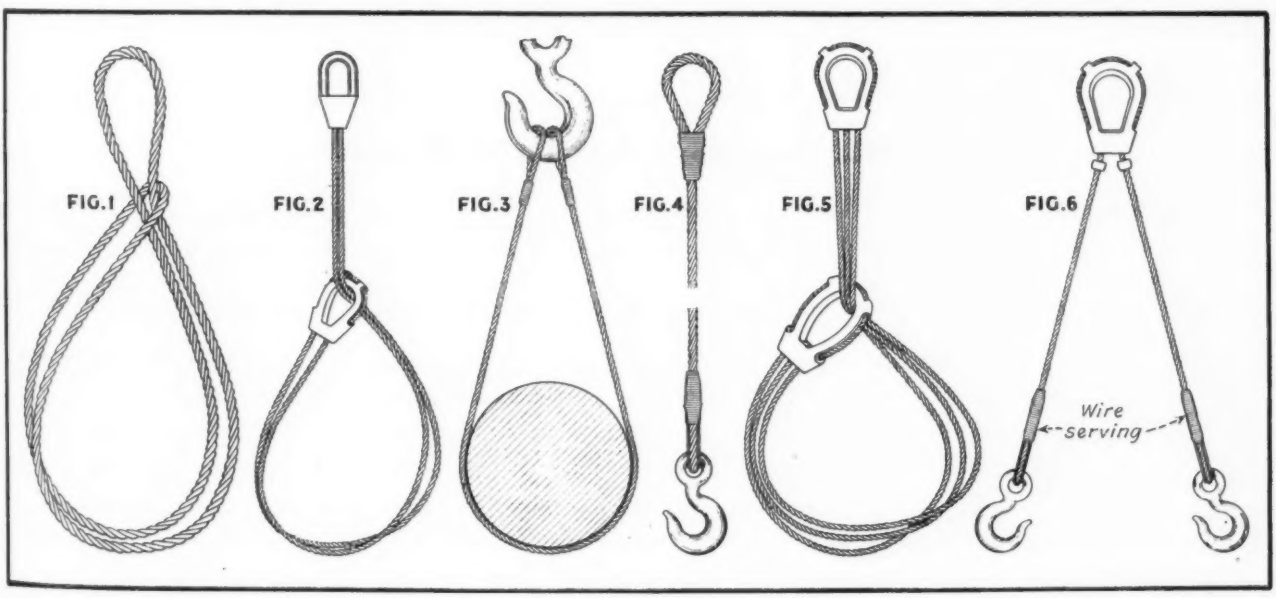


Fig. 1—The endless sling, usually formed into a noose, known as a choker or anchor hitch, is slipped around the object to be lifted, free bight being placed on crane hook. Fig. 2—Bights are sometimes threaded through drop-forged thimbles. Single-rope slings are made with spliced eyes, Fig. 3, or an eye and hook, Fig. 4. Equalizing thimbles, Fig. 5, permit making slings with several ropes in parallel or single sling with hooks at both ends, Fig. 6

that will not cut the sling, nevertheless the individual wires being bent sharply will be highly stressed, possibly beyond the elastic limit.

Do not permit wire-rope slings to kink because this also causes high bending stress. In addition, it subjects displaced strands to unequal distribution of the live load, some strands taking several times their normal load in addition to the stress produced by sharp bending. Even though an attempt is made to remove a kink, damage to the rope is usually permanent and accounts for many sling failures. Most wire-rope slings, like hoisting cables, are of 6x19 construction and of plow steel or improved plow-steel grade, but very large sizes are often made of 6x37 or 6x6x19 construction for increased flexibility.

All slings that have at some time been bent sharply become *cranky*; that is, they develop permanent deflections so that when the strain is relieved they snarl up in an unpredictable manner. This is annoying, to say the least, and means continual vigilance to keep them from developing kinks when taking a strain preparatory to lifting a load. Slings of preformed rope behave somewhat better than those made in the conventional manner, and also have the advantage that broken wires will not wicker out and present a hand hazard to the rigger, but rather lie *dead* in their original position.

The term *sling* includes a wide variety of designs. Perhaps the simplest is the grommet or endless type, Fig. 1, which uses six complete loops of a single strand laid or twisted around itself and a piece of the hemp center on each successive loop. The ends are then tucked into the space where a short length of the hemp center has been removed, as in making a long splice. This sling is usually formed into a noose known as a choker or anchor hitch, which is slipped around the object to be lifted, the free bight being placed on the crane or derrick hook. When strain is taken on the sling it crowds in and squeezes the load. Therefore, to assure a firm grip, strike the bight that bears on the hauling part with a piece of 2 by 4 to make three 120-deg angles between the component parts at the bight. These slings are sometimes made with the bights threaded through drop-forged thimbles, Fig. 2, which reduce wear on the strands and at the same time keep the rope from being bent too sharply.

Straight Slings

Another simple type is the straight rope with a spliced eye at each end, either with or without thimbles. Such slings are generally used, almost always in pairs, to make the *U* or basket hitch, Fig. 3. Passing one eye through the other makes a choker hitch.

Straight slings, Fig. 4, are made with a combination of rings, hooks, open or closed sockets on the ends. When used in pairs: (1) They are attached to eye bolts or lugs on the object to be lifted. (2) Both ends of each sling may be attached to the crane hook to form a basket hitch. (3) One sling may be used to make a choker hitch.

It is not necessary for straight slings to be limited to one piece of wire rope. Cable may be arranged with two, three, four, five or even six parts by passing around equalizing thimbles at each end of the sling, Fig. 5. Ends of the rope may be socketed into special thimbles, or it may be of endless or grommet construction.

For lifting such loads as large pipes a 2-leg bridle sling is frequently used. It may be (1) two straight slings with thimbles or rings at the upper end and hooks at the lower end, Fig. 4, which are engaged into the ends of the pipe or (2) a single sling with hooks at the two ends and an equalizing thimble at the middle, Fig. 6, which is attached to the derrick or crane hook.

For heavier loads slings have three or four legs. These are equipped with hooks or eyes according to the type of load handled, Fig. 7. There are an unlimited number of possible designs for sling terminals, such as special clamps for handling steel plates flat or in a vertical plane. For lifting foundry flasks, special flat plates are bent into the form of a hook, Fig. 7*B*, because it is bad practice to pick up a load on the bill or point of an ordinary hook.

For barrels or drums, it is customary to use a sling that has both ends attached to the crane hook by spliced eyes and a ring, with two special bent-plate hooks floating on the bight of the rope, Fig. 8. The hooks are engaged in the barrel chimes, and when a strain is taken on the sling they are automatically pulled toward each other, thus assuring a firm grip on the load. For handling wooden boxes, the bottoms of which cannot fall out, a sling of this type is sometimes fitted with sharp-

SAFE LOADS ON SLINGS IN TONS: FACTOR OF SAFETY 5

6 x 19 PLOW STEEL ROPE							IRON COIL CHAIN							8-PART BRAIDED SLING (ATLAS)						
Rope dia in.	Single leg Vertical	2-leg slings 60°	45°	30°	Basket hitch	Weight per foot, lb	Stock dia in.	Single leg Vertical	2-leg slings 60°	45°	30°	Basket hitch	Weight per foot, lb	Dia of rope used in.	Single leg Vertical	2-leg slings 60°	45°	30°	Basket hitch	Weight per foot, lb
3/8	1.20	2.08	1.70	1.20	1.70	0.23	3/8	0.90	1.56	1.28	0.90	1.28	1.67	1/8	0.77	1.34	1.10	0.77	1.10	0.18
1/2	2.05	3.55	2.90	2.05	2.90	0.40	1/2	1.50	2.60	2.14	1.50	2.14	2.80	3/16	1.71	2.96	2.42	1.71	2.42	0.42
5/8	3.15	5.46	4.45	3.15	4.45	0.63	5/8	2.31	4.02	3.28	2.31	3.28	4.40	1/4	3.25	5.63	4.60	3.25	4.60	0.80
3/4	4.50	7.79	6.36	4.50	6.36	0.90	3/4	3.38	5.88	4.80	3.38	4.80	6.25	5/16	5.04	8.73	7.13	5.04	7.13	1.28
7/8	5.67	9.82	8.02	5.67	8.02	1.23	7/8	4.67	8.12	6.64	4.67	6.64	8.30	3/8	7.06	12.23	9.98	7.06	9.98	1.84
1	7.39	12.80	10.45	7.39	10.45	1.60	1	6.20	10.80	8.80	6.20	8.80	10.65	7/16	9.41	16.30	13.31	9.41	13.31	2.48
1 1/8	8.18	14.17	11.57	8.18	11.57	1.96	1 1/8	7.80	13.58	11.08	7.80	11.08	13.25	1/2	12.10	20.96	17.11	12.10	17.11	3.20
1 1/4	10.09	17.48	14.27	10.09	14.27	2.42	1 1/4	9.60	16.70	13.62	9.60	13.62	16.25	9/16	15.12	26.19	21.38	15.12	21.38	4.08

Note: (1) Angles are between sling legs and horizontal. (2) For 3- and 4-leg slings, multiply 2-leg loads by 1 1/2 and 2 respectively.

pointed grab hooks to grasp the box.

Loads require a bar sling, Fig. 9, if they must be handled in a definitely level position as, for instance, the top half of a steam-turbine casing, which must not be permitted to foul the rotor blading while being handled. Providing it with turnbuckles permits the load to be carefully leveled. Such slings are usually attached to lugs or eyebolts on the turbine casing.

Attaching Fittings

Hooks and forged eyes may be attached to sling cables by various methods including eye splicing, spelter or babbitt socketing, also a special swedging process where the cable is inserted into a hole in the hook or eyebolt shank and the metal cold-worked into the recesses between the rope strands by a hydraulic press, Fig. 10, or by swedging: inserting the hook in a special clamp and applying the power of a blank cartridge to swedge it.

If the surfaces of the load to be lifted are liable to abrade the sling, the latter is sometimes served with wire or inserted through ferrules for almost its entire length.

Slings should be made of plow-steel or improved plow-steel rope, and only by experienced splicers. Always wrap the splice with serving wire to conceal the sharp protruding ends of wires that frequently injure riggers' hands. While not absolutely necessary, good practice dictates using thimbles in all spliced eyes. Likewise, only experienced men should do socketing. Exercise care to prevent the twist or lay coming out of the rope as it enters the throat of the socket.

In recent years a wire-rope sling has been developed that is replacing many of the conventional types of ordinary straight cable. This is an interwoven or braided sling made up of a number of small-sized wire ropes, usually eight, but sometimes as many as 48. In general, pairs of a right- and a left-lay rope are used, spirally braided to form a flexible non-kinking and non-spinning sling, which weighs only about one quarter as much as a chain of the same capacity.

Larger sizes containing a greater number of rope parts are usually braided around a hemp core, which acts as a cushion and helps keep the composite sling nearly round in cross-section. Even on 8-part slings the spiral braiding gives a much lower effective modulus of elasticity than a single cable of the same capacity. This greatly reduces the stress on the individual wires when a load is applied rather suddenly, thereby increasing the safety factor.

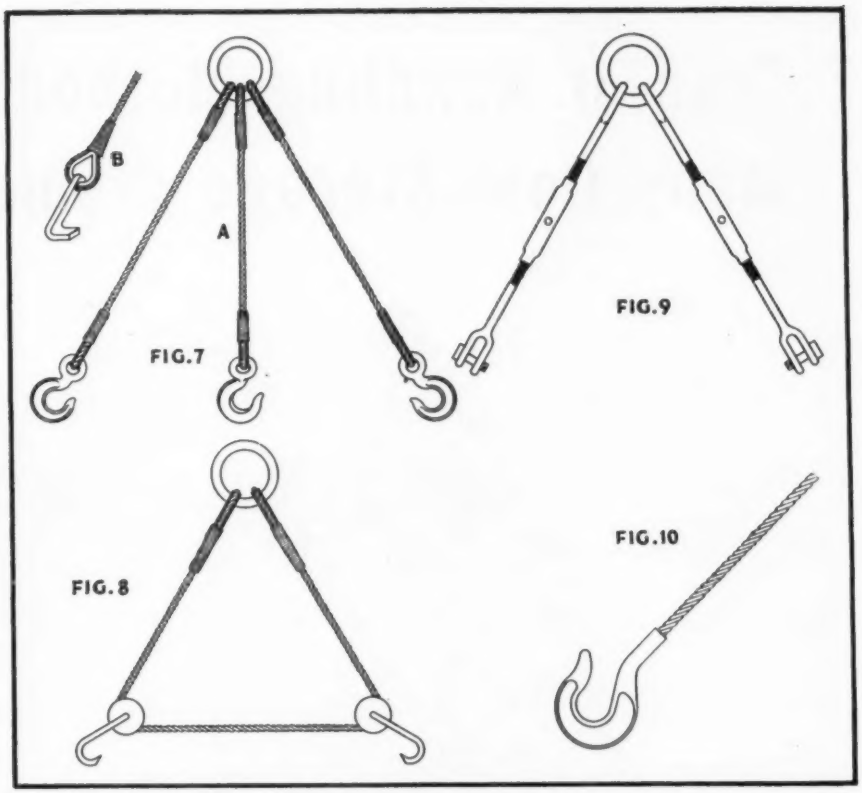


Fig. 7—For heavy loads 3- and 4-leg slings are fitted with hooks or eyes according to the object to be handled. Special plate hooks, Fig. 7B and 8, are used instead of picking the load up on the bill or point of an ordinary hook

Braided slings are also constructed to be almost flat, particularly for basket hitches to lift heavy shafts. For an object of large diameter such as a locomotive boiler, a sling made up of a number of wire-rope loops wound back and forth between two heavy-duty thimbles is used. These ropes lie parallel to each other and are served at frequent intervals to bind them into one unit. Never bend such a sling around small diameters nor pass it over sharp edges of the load.

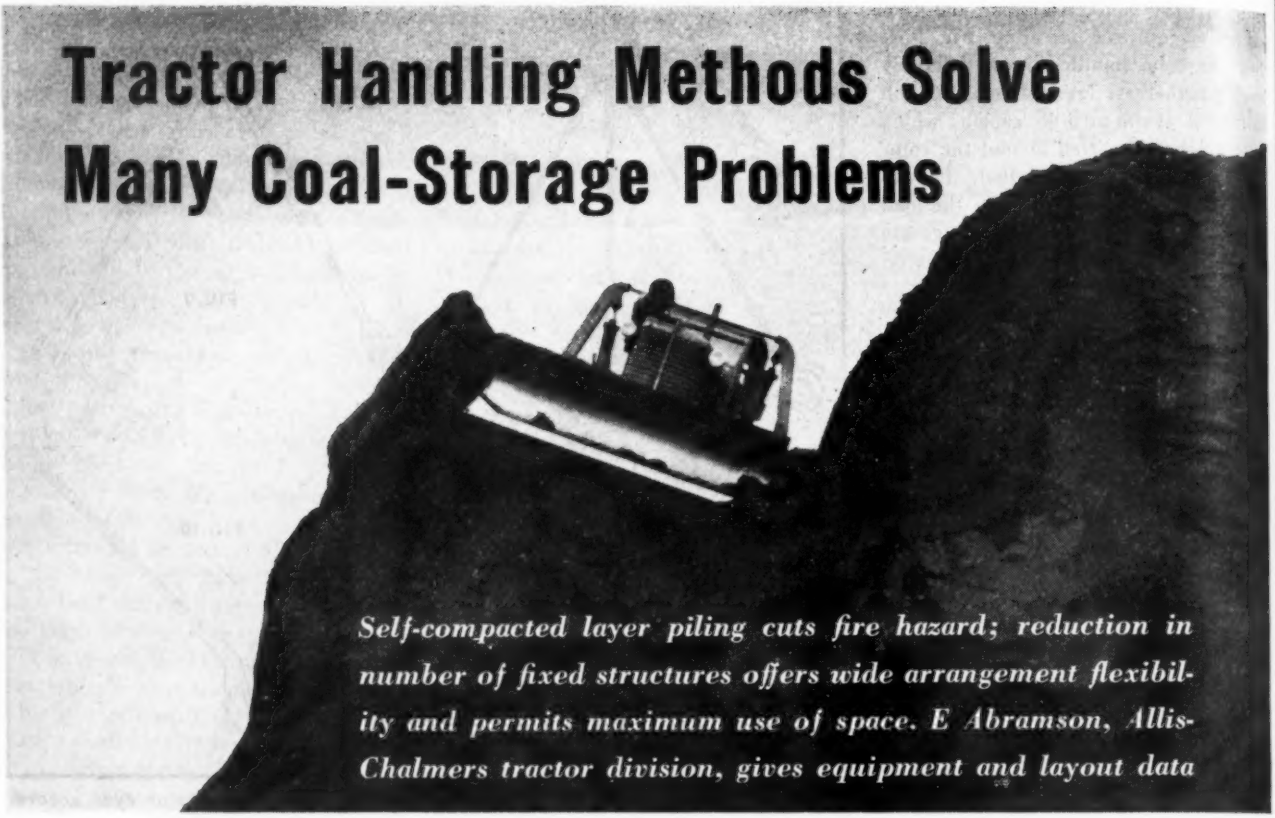
When lifting a load give special consideration to the angle that the sling legs make to the horizontal because lifting capacity decreases much more rapidly than might be expected as the angle is reduced. For each single leg or part of the sling at any angle of 60 deg, lifting capacity is only 87% of that at 90 deg or vertical; at 45 deg it is 71%, and at 30 deg, only 50%.

Accompanying table gives the safe working loads with a safety factor of five for conventional wire-rope slings, iron-chain slings and Atlas braided slings. Loads for the single slings are self explanatory. The 3rd, 4th and 5th columns of each group give the loads for 2-way slings at various angles. For 3- and 4-way slings increase these loads 50 and 100%, respectively. Theoretically, the basket hitch, shown in column 6, should have twice the strength of the single sling as it has two parts, each with the strength of the single sling. However, in actual practice the eyes at the ends of the basket sling hang on the same crane hook. This causes the legs of the sling to be considerably less than 90 deg to the horizontal, which accounts in part for the reduction in strength given in the table.

Braided slings, as well as ordinary wire-rope slings, are manufactured by others than the Macwhyte Company, but the figures given above are representative of almost all slings of these types regardless of who makes them.

Inspect slings periodically and condemn unsafe ones. A few broken wires do not perceptibly weaken a sling unless located near a socket throat, in which case they may indicate fatigue of the rope metal. If not crushed too severely, the rope strands may be hammered back into shape with a wooden mallet and block. Protect slings against corrosion and from contact with injurious chemicals and provide special hooks to keep them hanging straight when not in use. With reasonable care a sling should last indefinitely and be one of the safest parts of the hoist.

Tractor Handling Methods Solve Many Coal-Storage Problems



Self-compacted layer piling cuts fire hazard; reduction in number of fixed structures offers wide arrangement flexibility and permits maximum use of space. E Abramson, Allis-Chalmers tractor division, gives equipment and layout data

▶ INDUSTRY HAS PROBABLY STORED and reclaimed more coal during the past few years than in any like period, and has done much of the stockpiling under adverse conditions. In these operations the track-type tractor and its companion tools, the bulldozer and the scraper, have demonstrated many abilities that assure them a place in postwar coal-storage planning. Chief among tractor-handling virtues, perhaps, is the high degree of fire safety assured by the self-compacted layer piling. In addition, tractor methods offer flexibility in storage arrangements, ability to use available space with maximum effectiveness, and lower investment costs. Tractor equipment may also be used in conjunction with or as auxiliaries to other types of coal-handling equipment, either fixed or portable.

Provision against coal loss by spontaneous combustion forms a major consideration in all coal-storage planning. Most operators are familiar with the general theory of the chemical combination of air-borne oxygen and coal, which causes temperature rise and eventual burning. Such conditions are avoided by keeping amount of air reaching the coal surfaces to a minimum. This means eliminating segregation as far as possible, and compacting the storage pile.

When coal drops from a chute or spout to form a conical pile, coarse pieces roll or slide to the outside and bottom, while fines tend to stay in the line of fall. In such a pile, or in large piles built up by dumping many loads, amount of air flow varies widely from place to place because some parts are packed tight and others are loose. There is always a chance that at some one spot enough oxygen will reach the coal to start heating, but there will not be enough air flow to carry away the heat. Resulting temperature rise will speed the reaction between oxygen and coal.

Fig. 1—Tractor-bulldozer spreads coal on stockpile at rate of 1500 tons in 9 hours, over a 100-ft haul. Such units prove suitable up to hauls of 300 ft

* *Coal-Handling Systems for Central Stations, by George C Daniels, mechanical engineer, The Commonwealth & Southern Corp, Mechanical Engineering, Nov, 1941, pp 801–806.*

leading to further heating and eventual burning. Unless promptly detected and stopped, such local overheating or burning spreads, and loss of part of the pile results.

Layer piling avoids segregation difficulties by insuring mixing of fine and coarse particles, and thus prevents wide variations in air flow throughout the pile. Compacting carries the layer idea one step further: coal is piled in thinner layers and each layer is thoroughly mixed and packed down. Compacting apparently depends only to a limited extent on weight applied, the most important factor being mixing action.

Compacted-Coal Density

According to G C Daniels,* coal compacted by bulldozers weighs between 62 and 65 lb per cu ft as against 50 lb for loose coal and 56 lb for coal at the bottom of a 30-ft uncompacted pile. Increased density from compacting means less air circulation and less spontaneous heating and it also allows a gain of 10 to 15% in amount of coal stored in a given space.

It can be seen readily that tractor equipment offers flexibility. Systems can be changed on short notice to meet expanding or contracting needs. If it is necessary to store more coal in a given amount of time, extra units, borrowed or rented, can be added to handle desired volume. Contraction of storage operations leaves no fixed investment in idle equipment.

Virtually any path forms a right-of-way for a crawler tractor. Storage areas

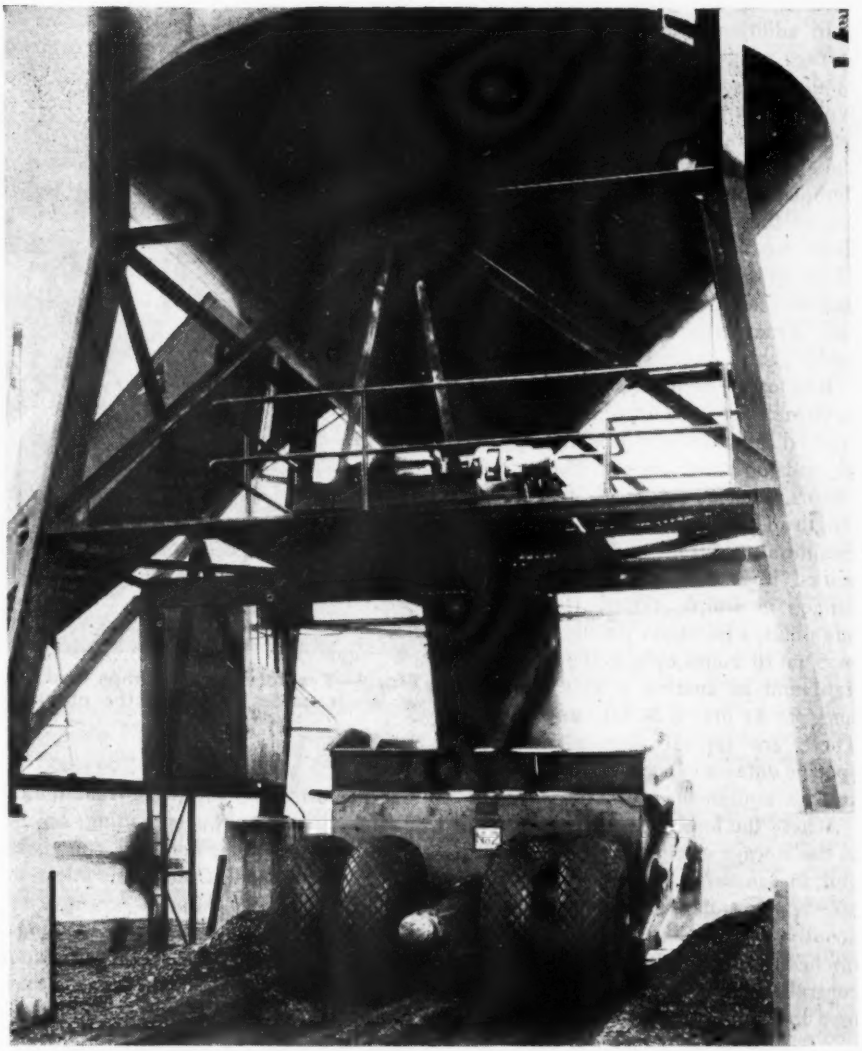


Fig. 3—Hopper loads scraper with 24 cu yd of coal for haul to storage pile. Note build-up sides to increase scraper capacity. Hopper loading is speedy

Fig. 2—Tractor-scrapers, suited for hauls above 300 ft, pick up loads at storage pile and carry them to track hopper at 70 tons per hr for 600-ft haul

may be planned to take advantage of irregular spaces and need not be limited by track layouts and other fixed structures. For example, a plant in the Middle West increased coal capacity of an irregular storage space by more than 300% when it adopted tractor handling. Storage piles built by tractors and auxiliary equipment may run as high as 35 or 50 ft and cover areas several hundred feet in either direction.

There are two basic types of tractor equipment: the bulldozer and the tractor with a scraper. These may be used separately or in combination. Where volume of coal to handle is not too great and the storage area not over 300 ft from the loading point, a tractor bulldozer handles the work efficiently. The bulldozer pushes its load out from the initial point, moving it to the desired piling area. It spreads the coal in layers, levels them and compacts the mass in a single operation. In reclaiming, the load is picked up at the edge of the pile and pushed to the desired point for

transfer into the plant's indoor storage.

In addition to use as a major coal-storage unit, the bulldozer finds many applications as an auxiliary to other types of equipment. For example, where overhead crane equipment is installed, the bulldozer may spread the coal dumped from the bucket, layering and compacting it. In reclaiming, the bulldozer may bring coal within easy reach of the grab bucket, speeding operations and increasing effective area of operation. Tractors often spot railroad cars under gantry or crawler cranes.

Bulldozer equipment can be applied to virtually any tractor of the heavy-duty tracked type. Because handling capacity depends on a number of highly variable factors, such as layout of storage area, length of haul, and method of building the initial pile from which the bulldozer works, it is difficult to state capacity ranges in simple terms. However, in one plant, a bulldozer handles 1500 tons in 9 to 10 hours over a 100-ft one-way haul and in another a unit moves 37 tons per hr over a 300-ft one-way haul. These are typical performances; for specific data on capacity it is best to consult an equipment builder.

Where the haul from the initial point to the storage area exceeds about 300 ft and, in general, for large-capacity operations, the tractor-scraper combination usually proves best. The scraper is hitched to the tractor drawbar and is controlled either by means of a cable or a hydraulic system.

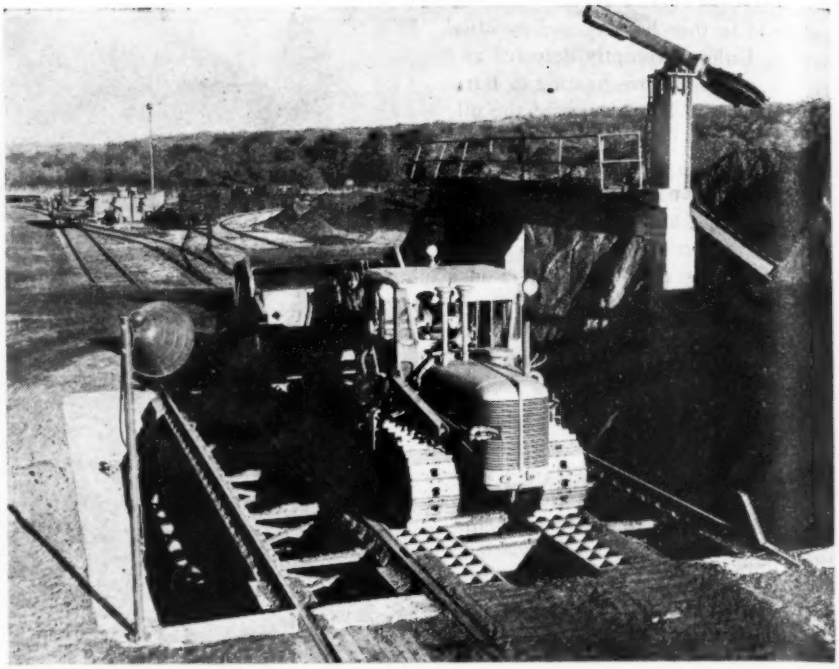


Fig. 4—Tractor-scraper dumps load into track hopper served by a belt conveyor which transfers coal into the plant, a common reclaiming arrangement

It performs the following functions: loading, transporting, spreading, leveling and compacting. Scrapers can pick up their own loads from loose piles or can be loaded from hoppers, conveyors, clamshells, or by other means. Loading completed, the operator shifts the tractor into higher "travel" speed and the scraper carries the coal quickly to the storage area, which may be up to 1500 ft away.

A gradual ramp is built up as the storage pile increases in height to enable tractor and scraper to reach the top without slowing down into low gear. On the pile, the scraper dumps and spreads the load in 4- to 6-in. layers, after which it swings around and returns for another load, thus completing the cycle. In travel back and forth across the pile, the scraper and tractor compact the layer-piled coal.

Reclaiming operation with the tractor-scraper is equally simple. The scraper scoops up its load and hauls it away at high speed to point of transfer to the plant. Generally, coal volume handled during reclaiming runs less than during storing operations, even though length of haul is the same, because of the greater time required to load compacted coal as compared to loose coal.

Scrapers of various designs come in capacities ranging from about 3 to 20 cu yd. Such capacity figures, however, are affected to some extent by method of loading; if scraper receives its load from a hopper, for example, a tractor can handle a much larger scraper. Under normal conditions, tractor power runs about 8 to 12 hp per cu yd of scraper capacity, but these figures are also affected by the previously mentioned variable factors in scraper capacity. In a typical installation, a tractor with a 15-yd scraper handles 140 tons per hr on a 600-ft roundtrip haul.

It is apparent that mobile equipment

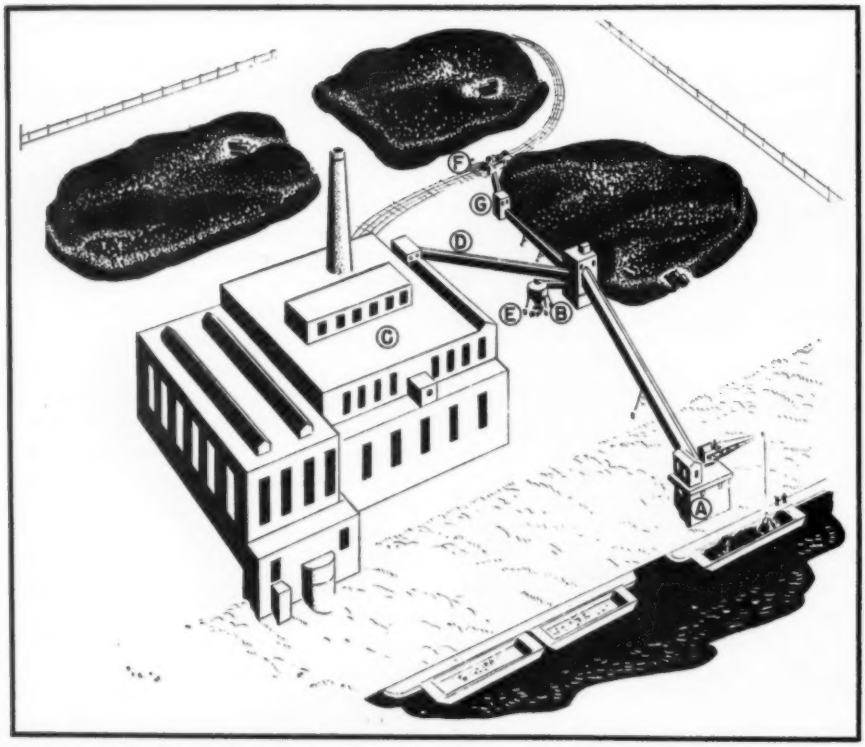


Fig. 5—Flexible system for large utility plant receiving coal by water or by rail

lends itself to an almost infinite variety of storage layouts and operating methods. However, the typical system consists of an unloading point from which coal goes into the plant for immediate use or into storage. The tractors haul from a loose pile or loading device at the initial point to the stockpile and reclaim from the pile to point of delivery into the plant, which is often, but not always, the loading point.

Nature of the loading arrangements depends largely on the method of receiving coal and the installation's size. Where coal comes in directly by truck and thus can be dumped into a loose pile, tractor equipment can work directly from such a pile. Where coal comes in by rail, permanent or portable unloaders may form a loose pile or load scrapers directly. Unloaders may work out of a pit beneath the tracks or, if of suitable design, directly from underneath the hopper bottom of the car.

If cars run onto an unloading trestle, the tractor equipment can often work from the loose pile formed under the trestle provided there is sufficient head room and space to maneuver. Cars are sometimes unloaded by locomotive or stationary cranes and this equipment also finds common use for unloading barge shipments. For large waterside installations, coal towers, either stationary or traveling, may be used. Cranes and towers may build piles for bulldozers to work from or fill hoppers under which scrapers can load. Self-unloading boats can build loose piles or load hoppers and need no unloading installation.

In reclaiming operations, either bulldozers or tractor-scrapers can work directly out of the storage pile without auxiliary loading equipment but it sometimes proves desirable to team them with cranes or shovels. They usually discharge to a track hopper or grizzly.

To illustrate the variety of arrangements possible, Fig. 5, 6 and 7 show typical layouts for large, medium and small plants, receiving coal by truck, rail and water. Fig. 5 illustrates the flexible and efficient system for handling large volumes of coal devised by an eastern utility. Crane *A* unloads coal from barges, from which point it is transferred to a central tower *B*. Coal to meet daily requirements of the plant *C* travels over a conveyor *D*. Surplus coal for storage is routed into hopper *E*. Tractor-scraper units load from the hopper and haul coal to one of three storage areas, depending on volume of coal stored.

Reclaiming Operation

Tractor-scrapers reclaim coal, picking up their load at the storage pile and hauling to *F* where coal is dumped into a track hopper or grizzly. Here a belt-conveyor *G* transfers coal into the central control tower *B* and thence by conveyor *D* to the plant. If coal comes in by rail it is dumped into the track hopper *F* and either follows the conveyor route into the plant or goes to the hopper at *B* to be hauled to storage by the tractor-scrapers.

Fig. 6 shows a somewhat smaller installation. Here, self-unloading boats discharge directly into rail cars for immediate transfer to the power plant, about 20 miles away. Coal for storage is unloaded on dock and picked up by self-loading scrapers, tractor drawn. Main storage pile is 600 to 700 ft from the dock. Scrapers make this haul, spread out and compact their loads and return to the loading pile to repeat the cycle. In reclaiming, bulldozers push coal within reach of a crane with a clamshell bucket, which transfers coal to cars for rail transport to the plant. This layout illustrates a typical solution to the problem of storage at a point remote from the powerhouse. If the pile were adjacent to the plant, a conveyor system would undoubtedly replace the cars for transfer into the plant from initial unloading point and from reclaiming operations. If means of shipment other than self-unloading boats were employed, towers or cranes would have to be provided.

Fig. 7, the simplest layout, fits a wide variety of small-plant applications, modified in detail to suit local conditions. Coal comes to the unloading point by rail and is discharged into a hopper which feeds a skip-hoist or conveyor taking coal directly into the plant. Surplus coal for storage is handled by another short conveyor which builds the initial loose pile from which the bulldozer spreads it into horizontal layers for permanent storage. In reclaiming operations the tractor equipment discharges into the hopper for delivery into the plant.

The basic scheme outlined above might be applied even without a hopper. A portable unloader could be arranged to discharge directly into the plant bins, if convenient, or to a skip-hoist or conveyor leading into the building. The portable unloader could be shifted when needed to build a pile for the bulldozer or load a scraper. Where coal comes to the plant by truck, the load can often be discharged directly into the plant bunkers or to a conveyor leading to them. By merely changing the point of dumping, the truck can form a pile for the bulldozer of scraper.

It is apparent that tractor equipment, if properly applied, offers flexible storage handling with low investment in equipment. Likewise, tractors and their auxiliary tools prove economical in operation. A large tractor, developing 132 drawbar horsepower, operates on four to five gallons of diesel fuel per hour. Only one operator is required for tractor, bulldozer and scraper. However, it is difficult to estimate total costs of operation because of differences in local conditions, particularly in load factor.

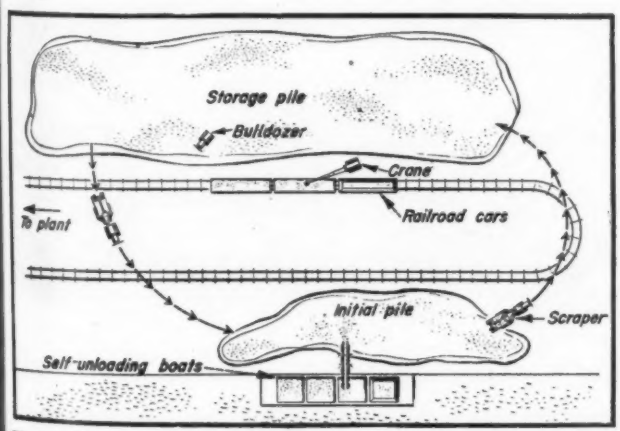


Fig. 6—Scrapers and bulldozers serve waterside storage

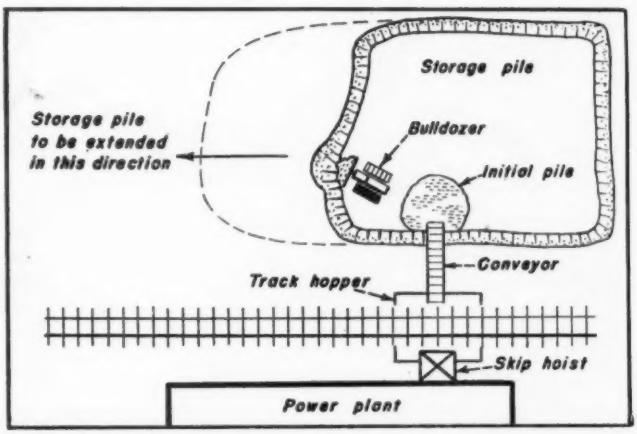


Fig. 7—Layout for small plant that receives coal by rail

Five Steps To Good Lubrication

Diagnosing lubrication troubles and preventing their occurrence requires five kinds of know-how relating to the equipment and the lubricant. This article completes the outline of these fundamentals begun in the July issue

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▶ OUTLINING FIVE REQUIREMENTS for successful lubrication, a previous article (July POWER p 88) discussed the relation of equipment design and operation to lubrication, properties of petroleum lubricants, and some of the changes that take place in an oil during service. This final article covers nature and effects of the catalytic reactions between metals and petroleum lubricants and the general question of oil purification.

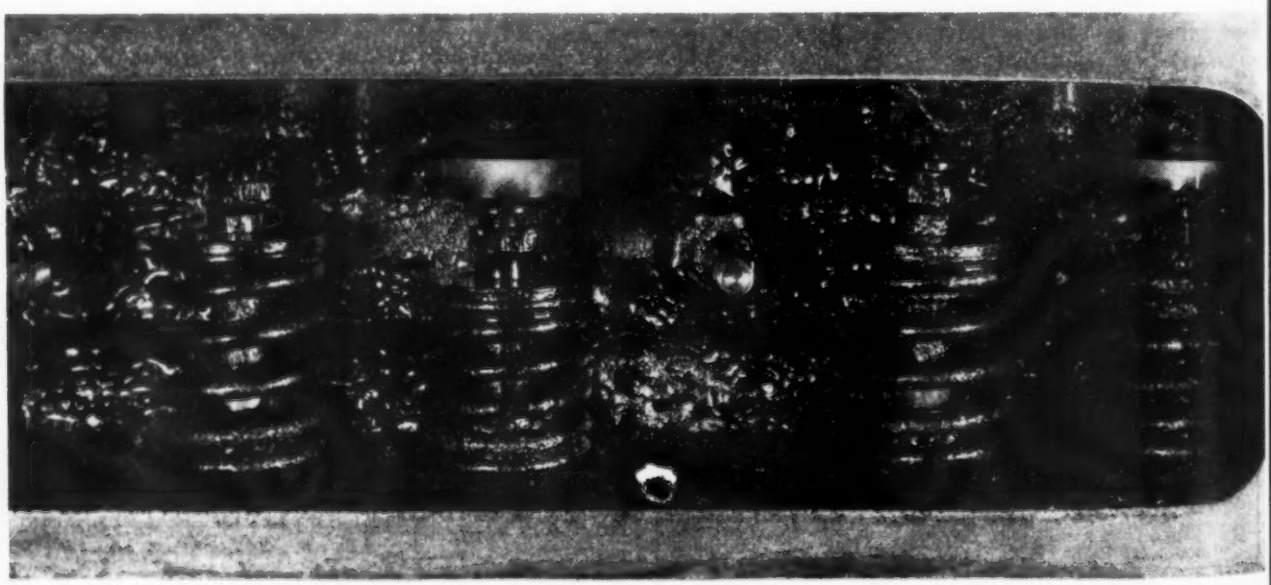
The catalytic influence of metals on lubricating oils is not generally understood. In construction of machines and their oiling systems metals vary from one unit to another. Some have a more pronounced catalytic influence on oils than others. Most-commonly used metals may be listed in order of *increasing* severity of catalytic influence as follows: aluminum, tin, iron, lead and copper.

Such metals in contact with lubricating oils undergoing oxidation react to form metallic soaps or organic compounds. These occur as sludges, more pronounced where moisture, liquids or solids are present. Sludges in any amount prove objectionable because they precipitate and collect at points throughout the system, frequently clogging oil lines, screens and filters and thus impairing lubrication.

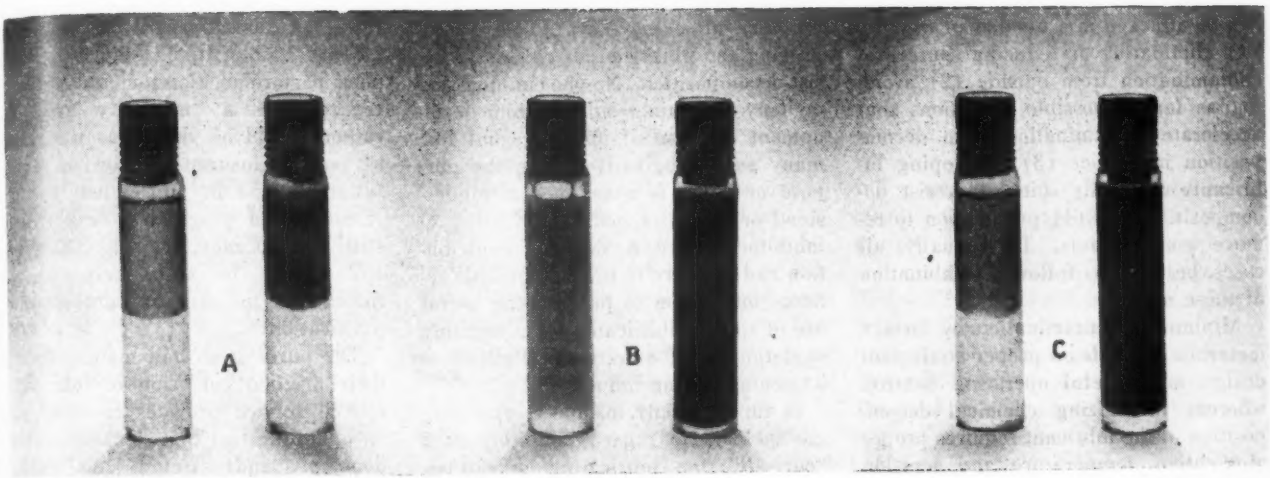
Often sludges and deposits are blamed on the quality or suitability of the oil in service. To correct a condition, many operators change to another type or brand of oil. While it is true that sometimes an improvement may result, the trouble cannot be eliminated completely as long as the basic or contributing factors remain unchanged. As operators become more familiar with the fundamental causes of lubricating-oil decomposition and take proper steps to overcome them, a pronounced improvement in lubrication of mechanical equipment throughout industry may be expected.

In large circulating systems with coolers and storage tanks, the area of metal in the oiling system in contact with oil is many times greater than metal area in bearings or moving parts of the machine being lubricated. Thus decomposition of the lubricant resulting from catalytic reaction with metals in the oiling system may be more detrimental than that from reaction with bearings or other lubricated parts. Large steam turbines are a good example. Parts to be lubricated usually consist of four main bearings and the governor mechanism. By comparing surface area of these parts with metal area of the oiling system the effect of the latter on oil decomposition becomes apparent.

Corrosion and iron-oxide accumulation present a serious operating hazard. In oiling systems, corrosion of ferrous metals results from entrained water or moisture in the oil and the volatile and corrosive organic acids formed by oxidation of the oil. In operation of steam turbines and other major mechanical units, it is difficult to guarantee that water or condensate will not enter



Sludges formed by catalytic reaction of metals and lubricants undergoing oxidation are objectionable in any amount because they precipitate and collect at points throughout the system, frequently clogging lines, screens and filters



Photos show effect of contamination on an oil's ability to separate from entrained water: A—Bottles contain same turbine oil and same amount of water; oil at right is as taken from turbine, oil at left has been purified. B—Immediately after both bottles were heated to 120 F and shaken to mix oil and water thoroughly, water started to drop out of clean oil. C—Three minutes later, water had dropped out of clean oil completely but not out of dirty oil to any appreciable extent. After three hours, water level in the dirty oil tube had still not changed perceptibly

the system at one time or another. In addition to corrosion, this water causes oil deterioration in another way; the iron oxide in contact with oil accelerates its oxidation and decomposition as well as impairing its ability to separate from entrained water.

In recent years corrosion has received considerable attention throughout industry, resulting in a general demand for a "noncorrosive" lubricating oil. Refiners now market oils containing water-corrosion inhibitors. These may differ slightly from one manufacturer to another but, in general, high-molecular-weight organic acids are added to the oil in minor percentages. They should have preferential wetting power for metals, precipitating or plating out on the surface of the metals with which they come in contact, thus preventing water or other corrosive elements from reaching them.

Inhibitor Problem

Scientists face a difficult, if not impossible, chemical problem in providing an inhibitor that will plate out and prevent water corrosion without impairing other essential lubricant properties, such as resistance to decomposition and ability to separate from or drop entrained water readily. Thus there are two schools of thought regarding inhibitors: Some operators report improvements and demand inhibited oils while others refuse to use them, contending that their stability or resistance to oxidation and their steam-emulsion or water-separation properties are inferior.

A logical solution to the corrosion problem in an oiling system would seem to lie in fabricating it from non-ferrous materials, aluminum for example. The increased original cost would be negligible and a non-ferrous system would eliminate a major corrosion problem, enabling operators to use high-grade lubricants in connection with proper and adequate purification systems to maintain the oil in its original pure and clean condition indefinitely. The value of such an arrangement as insurance of maximum lubricating efficiency is worthy of serious consideration.

In addition to taking steps to neutralize or eliminate the effects of water in lubricating oils, as discussed above, it is important to remove or control it. While there is no adequate or satisfactory laboratory test method for evaluating the tendency of oils to separate from water, the emulsion, steam-emulsion or demulsibility tests may be indicative. In their original condition, the better grades of lubricating oils on the market separate quickly from entrained water. To provide water-separating properties, the refiner filters lubricating oils through fuller's earth. This has been the practice since the beginning, regardless of oil type, refining process or degree of chemical treatment. If water-separating properties are to be maintained in service, adequate purification systems must be employed to remove all contaminants that influence the water-separating property.

Time is an important factor in separating water, solids and other foreign materials from lubricating oils. It is not practicable in most systems to provide ample capacity to allow time for complete gravity separation of contaminants. Therefore, the most satisfactory means of maintaining a lubricant in its original condition is a purification system carefully selected to remove the objectionable contaminants regardless of their origin or nature.

Water can be removed most effectively from lubricating oil in its original condition by centrifugal separation. Oxidation of oil, formation of metallic soaps or organic compounds and creation of excessive amounts of sludge reduce the effectiveness of separation. The more finely divided solids, dust and iron oxide, which impair the water-separation properties of a lubricant, can be removed by absorbent or adsorbent purification systems. Fuller's earth proves a most effective filtering medium for removing oil-soluble organic acids, which also impair lubricant water-separating properties.

Effects of Service

Summarizing the discussion, in this and the preceding article, on petroleum properties, it can be seen that such lubricants, either oils or greases, are subject to deterioration in service as a result of: (1) contamination by foreign materials—gases, liquids, semi-solids or solids—and (2) contamination by the oxidation products of the hydrocarbons themselves, influenced by temperature and the catalytic effect of other elements. A sufficient percentage of any one or more of the contaminants renders a lubricant unsuitable for further use if operating efficiency of the unit is to be unimpaired. Thus, contrary to the ideas of many users, lubricating oils do not wear out; they become unsuitable for further use by contamination in service.

Obviously the contamination problem

can be attacked in a number of ways by (1) eliminating or reducing sources of contamination from outside (2) avoiding as far as possible conditions that accelerate contamination from decomposition in service (3) developing lubricants especially suited to resist decomposition and (4) purification to remove contaminants. In virtually all cases, best results follow a combination of these methods.

Minimizing contamination by foreign materials depends on proper equipment design and careful operating control, whereas minimizing chemical decomposition of the lubricant requires proper application, temperature and aeration control, and suitable selection of materials for the oiling system.

In day-by-day operation of mechanical equipment it is obviously impossible to control or eliminate all of these deteriorating influences. But experienced operators, knowing lubricants and their behavior, are able to determine the source of contaminating influences and thus to take steps to control the saboteurs at their source or remove them from the lubricant before they have caused damage. Life of lubricating oil in a well-designed machine equipped with a properly selected oil purifier should equal the life of the machine while assuring maximum lubricating efficiency over the entire period.

During the past few years, remarkable lubrication advances have resulted from perfection and adaptation of inhibitors—attacking the problem by improving the ability of lubricants to resist decomposition. No one can question or deny the gain resulting from development and use of inhibitors but like many such progressive steps, the purpose or value is sometimes misunderstood or overestimated. Lubricating-oil inhibitors prove a valuable contribution and are here to stay. Reputable refiners offer them to prolong the useful life of specific lubricants by minimizing oxidation and the detrimental effects of its contaminating influence.

In far too many instances, operators are inclined to regard inhibitors as a "cure-all" for lubricating difficulties. Such a conclusion is unjustified. Inhibitors can and do improve performance of a given lubricant in specific ways but are not offered or intended to overcome common difficulties. While a particular inhibitor may improve a specific condition or delay the formation of objectionable contaminants, it does not follow that its effectiveness lasts indefinitely or that it will completely eliminate all difficulties.

Completing the discussion of methods of attacking the problem of service contamination of lubricating oil, we come to purification. It should be more generally recognized that, regardless of how well a piece of mechanical equipment has been designed or how well the materials of its construction have been selected, useful life and performance depends solely on a film of oil. Successful lubrication offers the greatest assurance of uninterrupted service and efficient performance and should never be regarded as a "necessary evil" but rather should be viewed as the cheapest possible insurance against expensive failures. And in lubrication, the one scientific and progressive development, still in its infancy, not fully recognized and yet to be taken advantage of throughout industry, is continuous oil purification.

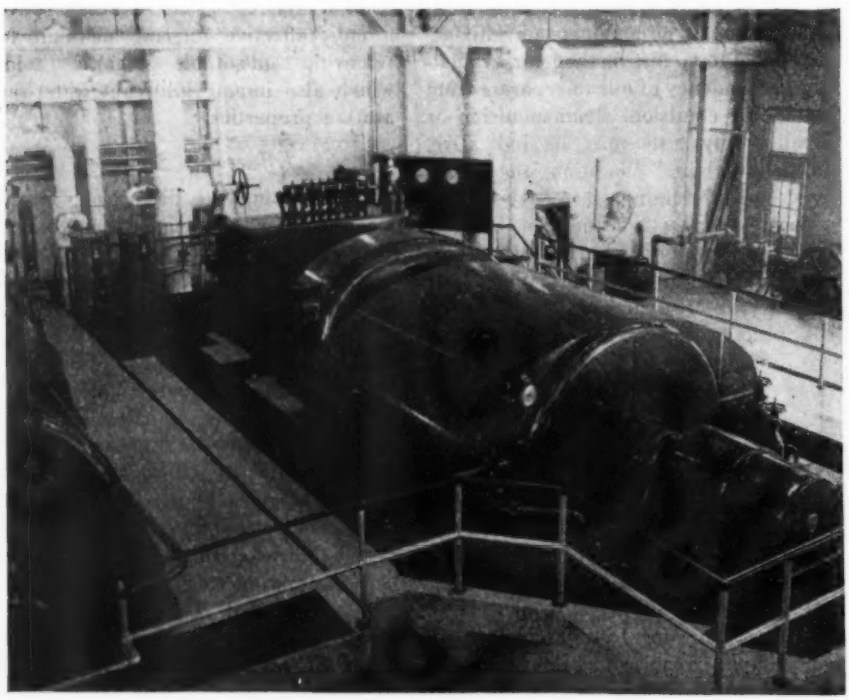
The purification and maintenance in their original condition of lubricating oils in service provides industry with an operating tool that promises tremendous dividends. Before this goal is reached and industry can take full advantage of the possibilities, considerable educational work must be done. Trained, qualified lubrication engineers must analyze a problem and prescribe the most economical, satisfactory and efficient solution. The engineer must first determine whether a specific problem is one of design, metallurgy, application or lubrication and make his final decision and recommendations accordingly.

Cooperative 4-Way Program

Industry, to realize ultimately the maximum operating efficiency of its mechanical equipment, must invoke a cooperative 4-way program. The first step is taken on the drawing board. The designer, well grounded in the science of lubrication, proportions parts and select materials to avoid excessive stress or overloading. The design should include provision for ample, continuous and uninterrupted supply of the proper lubricant to all moving parts at all times.

Excessive temperature seriously shortens lubricant life by accelerating oxidation and also lowers its viscosity, impairing load-carrying properties. Temperature control, therefore, is a basic factor in design of any mechanical unit. Finally, design should include every possible precaution to prevent contamination by foreign materials.

When all these important factors in equipment design have received due consideration, the operator plays his part by establishing a schedule of inspection and supervision consistent with the demands on the unit. Oilers, or those responsible for lubrication, follow a definite routine to prevent lack of lubrication or use of wrong grades. And last, but not least, oil purification systems are observed closely to see that oil is at all times completely free from contaminating influences and maintained in its original condition.



Continuous purification of lubricants in service offers great possibilities to industry's efforts to realize maximum lubrication efficiency and reliability

British POWER-TRANSFORMER Practice

▶ BECAUSE OF our tremendous steam and hydroelectric power plants, transmission networks and high per capita use of power we sometimes forget that large power equipment is built in lands outside our continent. These photos and the ones on page 98 give a brief review of power transformers built by British electrical manufacturers, some of them as large as or larger than this country produces, and for comparable voltages.

The three 40,000-kva 242,000-v single-phase transformers, Fig. 2, are an interesting recent advance in British transformer design. These units operate in a 3-phase 50-cycle delta-star-connected bank with 120,000-kva rated output at 15,750 to 242,000 or 120,000 v, with plus or minus 2.5 and 5% taps on each connection.

The 50-cycle dry-and-wet flashover values of their oil-filled terminal insulators are 690,000 and 470,000 v, respectively. Core of each transformer weighs over 60 tons and is of the 4-legged design to reduce transformer over-all height. Core and winding weigh 76 tons and the weight of a single unit assembled is 164 tons. Each transformer has two forced-oil air-blast coolers, but can carry up to 50% load with natural oil circulation. Fig. 1 shows the core-and-coils assembly for a transformer of almost double the capacity of each of those in Fig. 2. This is a 3-phase design rated 75,000 kva, 11,000 to 66,000 v at 50 cycles and it has a 3-legged core.

An unusual transformer development, a 200-kva 3300- to 550-v 3-phase delta-star-connected unit for mines is shown in Fig. 5. Mounted on wheels, it runs on the mine car tracks and is provided with lifting devices so that a hoist can pick up and place the whole assembly in any convenient place. Made for low headroom, the unit has an over-all height of only 31 in. Flameproof switches and cable boxes are provided on the primary and secondary sides so that a single unit forms a complete metalclad mobile substation.

A number of mobile 30,000-kva 132,000 to 33,000-v 3-phase 50-cycle transformers have been built to act as spare units for the British grid system. These were designed to be transported on standard railway cars within the limits of British right-of-way clearance.

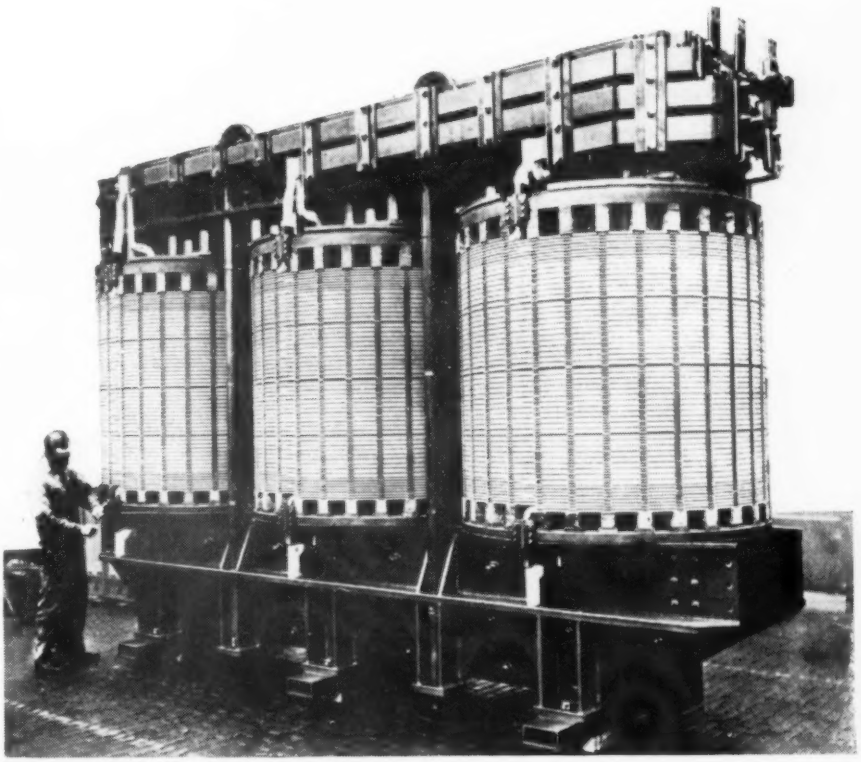


Fig. 1—Core-and-coil assembly for a 75,000-kva 11,000- to 66,000-v 3-phase 50-cycle forced-oil air-blast-cooled transformer. Core is a 3-legged design, and coils are wound to form a continuous disk without joints. Cooling ducts are provided in the coils and the low-voltage-phase leads are securely clamped against mechanical forces

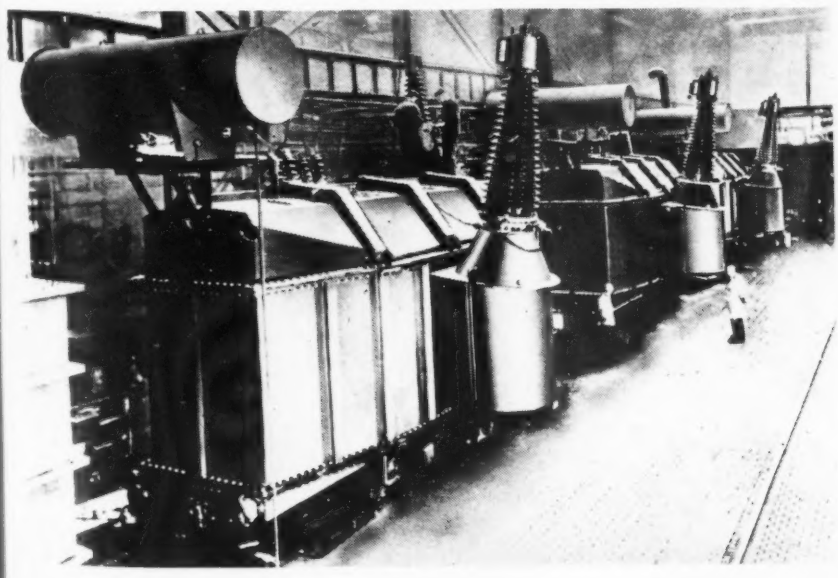
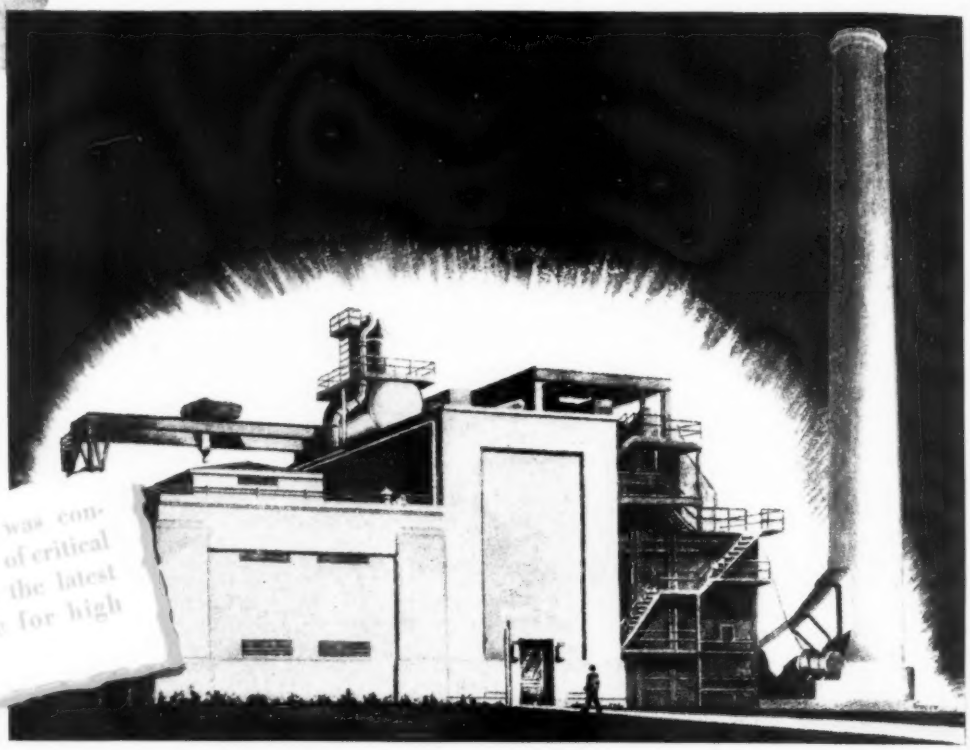


Fig. 2—Three single-phase transformers, each rated 40,000 kva, to operate in a 3-phase delta-star-connected bank with 120,000-kva output at 15,750 to 242,000 or 121,000 v. Two forced-oil air-blast coolers dissipate heat from each unit. Up to 50% load, coolers with natural-oil circulation keep transformer temperature within safe limits

(*Continued on page* 98)

ELECTRIC POWER

. . . never too late nor too little



Designed in April, 1941, it was constructed with a minimum use of critical materials, and it embodies the latest developments which make for high efficiency.

Another power plant is dedicated!

The wheels of industry are driven chiefly by electrical energy, which speeds production, reduces costs, multiplies manpower. The new steam electric generating station shown above will add nearly 50,000 horsepower to drive the wheels of SOUTH TEXAS industry.

Designed in April, 1941, it was constructed with a minimum use of critical materials, and it embodies the latest developments which make for high efficiency.

Today's electric power demands were foreseen long before the United States entered the war; but the new power plant, which today is meeting those demands, is dedicated to help win the war for freedom—and to the more than 540 employes of the Houston Lighting & Power Company who have left their families and jobs to enter the armed forces of their country. When victory is earned, this plant will be named for one of their number.

The war industries in the area served by the Company are extremely vital to the war program. Ships, steel, magnesium, synthetic rubber and petroleum are but a few products representative of South Texas' mighty contribution to ultimate decisive victory.

To provide dependable, low cost electric service to these industries and to the people of South Texas who man them is this Company's privilege and responsibility. To that end the Houston Lighting & Power Company dedicates —not alone the new power plant—but its manpower, resources and experience.

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Reprinted from The Houston Press, July 7, 1943

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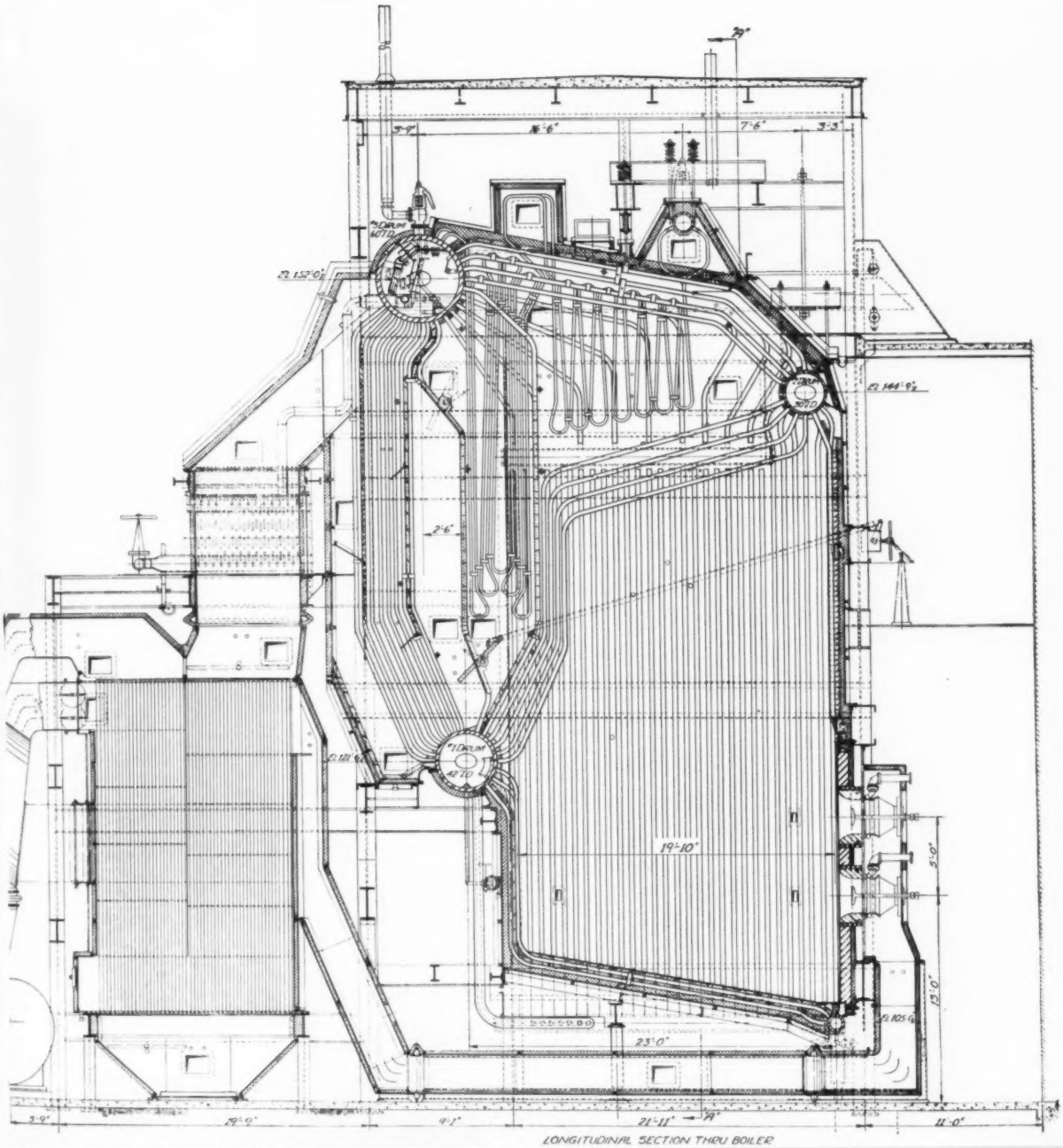

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- Iowa-Illinois Gas & Electric Co.
- Central Illinois Light Co.
- Northwestern Public Service Co.
- Upper Mich. Power & Light Co.
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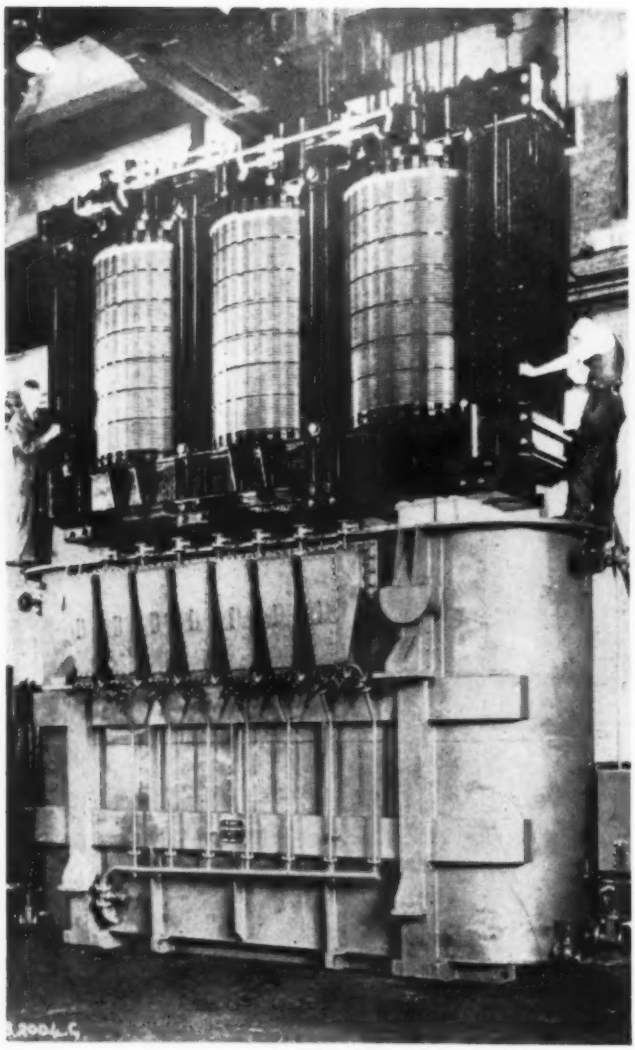


Fig. 3—Core-and-coil assembly for a 62,500-kva 11,500- to 33,000-v 3-phase 50-cycle transformer being lowered into its tank. Core is a 5-legged design to reduce transformer over-all height. Adjustable coil clamps fitted to windings compensate for insulation shrinkage that may occur in service. Hot oil from the top of the transformer tank is circulated by motor-driven pumps through two banks of external radiators with air-blast cooling

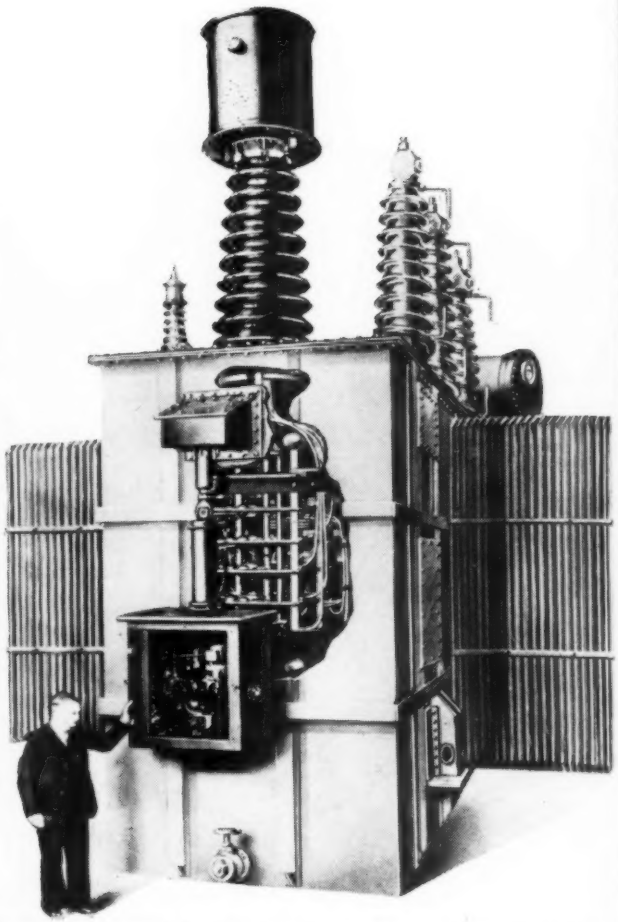


Fig. 4—A 15,000-kva 110,000- to 38,500 and 6600-v star-star-delta-connected self-cooled transformer with high-voltage on-load tap-changing equipment. Tap changing on 110,000-v winding gives range of plus or minus 2 to 12% steps and on 38,500-v winding a standard off-circuit tap changer provides plus or minus 2.5 to 5% steps of voltage regulation

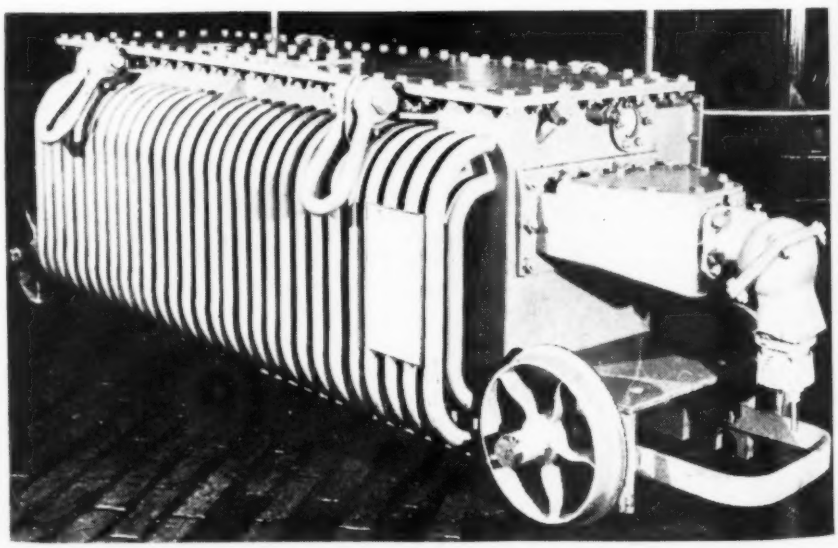


Fig. 5—Non-flameproof 3-phase mining transformer for underground operation where headroom is low. This unit, rated 200 kva, is delta-star-connected for 3300 to 550 v and has an over-all height of 31 in. Flameproof switches and cable boxes can be provided on the primary and secondary sides so that a single unit forms a complete metal-clad mobile substation for a mine

FREIGHT RATES *and* INDUSTRY LOCATION

A SIGNIFICANT decision, announced by the Interstate Commerce Commission last May, will take preliminary effect on the 30th of August. It will eliminate some of the advantage in freight rates which Eastern shippers have enjoyed over shippers of the South and West.

The decision has been enthusiastically hailed as an Emancipation Proclamation for industrial development in the South and West. It has also been roundly condemned as a meddlesome control measure that ignores valid differences in haulage costs, and recklessly blots out one of the important factors in determining the location of American industry.

Cooler appraisals indicate that the net effect of the rate changes will be far less drastic than predicted by the more passionate advocates or adversaries. Nonetheless, it is important for the business world to be informed both upon the principle at issue, and upon the forseeable consequences of the ICC ruling.

What The Decision Calls For

The Commission's order, unless modified, or successfully contested in the courts, will require: (1) the eventual establishment of a single freight classification, or grouping of commodities for rate-making purposes, for application throughout the United States; (2) a single level of *"class rates"*—or rates established for groups of commodities and primarily applying to manufactured and semi-manufactured articles of high value—in the area east of the Rocky Mountains. This level is to be about 15 per cent higher than the present Eastern scale.

Because it will take some time, probably several years, to work out a uniform classification in place of the three major classifications now existing, a preliminary adjustment is provided.

Under this adjustment the existing classifications will remain in effect, but the rates on articles moving on *class rates* will be increased 10 per cent in Eastern or Official Territory—the area east of Lake Michigan and the Mississippi River and north of the Ohio River. On the other hand, the rates will be reduced 10 per cent on articles moving on class rates in the South and West, and on those moving interterritorially.

What The Problem Was

At the present time there are marked differences in the levels of the basic scales of class rates in the five major rate territories—Eastern or Official, Southern, Western Trunk-Line, Southwestern, and Mountain-Pacific. It is difficult to average the levels of rates, but if the level of the class-rate scale in Official Territory is taken as 100, the levels in the other territories may be roughly considered as follows: Southern, 139; Western Trunk-Line, 128, 146, 161, 184 in Zones I, II, III, and IV, respectively; Southwestern, 161; Mountain-Pacific, 166.

These are over-all comparisons. On many individual articles the differences in levels of rates are greater or less than indicated because of offsetting differences in regional classification schemes. In many cases, the use of exceptions to the classifications and of special commodity rates has reduced the regional disparity in rates. In fact, on some articles, particularly on certain low-grade traffic such as logs, pulpwood, bricks, coal, sand and gravel, the South and the West have actually had lower rates than Official Territory. The rate disadvantage of the South and West has been principally on manufactured articles.

The territorial differences in class-rate levels have complicated the problem of constructing rates from a point in one territory to a point in another. Today, such a rate tends to represent a blend of the levels in effect at the place of shipment and at the destination. Thus manufacturers and dealers in a higher-rated territory are likely to see themselves at a disadvantage when they attempt to sell goods in a lower-rated territory against competition located there.

Now, if differences between territorial rate levels are removed, the *inter*territorial freight-rate problem largely disappears. So it is an important question whether such differences are justified. The Commission has found that they are *not* justified either by differences in transportation costs or by

other valid considerations. From that finding came the order to establish a uniform level of class rates and a single freight classification.

The Decision And The Map Of Industry

What effect will this decision have on the location of industry in the United States; and what effect will it have on the economic development of the East, the South, and the West?

Today, many in the West and South believe that their higher class rates have seriously retarded the industrial development of these areas, and promoted the concentration of manufacturing in Official Territory. They point out that Official Territory has over 50 per cent of the population of the country, had nearly 70 per cent of the persons employed in manufacturing in 1940, and accounted for nearly 73 per cent of the "value added by manufacture" in 1939. Boasts of industrial development in the South, and to some extent in the West, in recent years are accompanied by claims that this would have been greater but for the freight rate structure.

Another point gets into the argument. Official Territory is not only the country's most highly industrialized section, but also its greatest consuming territory. It is the market which nearly all manufacturers desire to reach, particularly when they have a surplus to sell. Here again is occasion for an outcry by producers outside of Official Territory against the consequences of their high rate levels and the levels of interterritorial rates. Under the circumstances it is not strange that the South and West have argued long and volubly for mile-for-mile equality in rates.

Those in Official Territory deny that the South and West have been handicapped by the rate adjustment, but at the same time look with apprehension at the loss of their rate advantage.

What's The Effect?

However, now that the ICC's ruling is about to be put in operation, it is time for the colorful statements of the debating period to give way to a sober appraisal of what the consequences are likely to be.

In the first place, it should be noted that the preliminary adjustment will affect only a small fraction of the traffic. Estimates indicate that only about 4 per cent of the full-carload traffic moves on regular class rates. About 11 per cent moves on exception ratings which are not affected by the preliminary order; and about 85 per cent moves on commodity rates, which were not within the scope of the Commission's decision. The proportion of less-than-carload lot traffic affected is much greater, since a large part of it moves on class rates; however, less-than-carload traffic constitutes less than 1½ per cent of the total tons carried.

The permanent rate structure will probably affect more traffic than the preliminary order since, in the establishment of a uniform classification containing more classes than at present provided, many articles now moving on exception ratings are likely to be brought within the scope of the classification, and the same may be true of some articles moving on commodity rates.

But, even if a large proportion of the traffic were affected by the Commission's order, or if the principle of equality in rate levels is eventually extended to much of the traffic moving on commodity rates, these freight-rate adjustments cannot be expected to revolutionize the pattern of industrial location in the United States.

It seems evident that most industries now found in Official Territory are located there for other advantages than that of a lower level of freight rates, undeniable as such an advantage is. Insofar as that is the case, they have little to fear from equalization of the rate levels. For those which have, indeed, been dependent upon preferential rates and otherwise badly located, the removal of the preference and their consequent shift to some area possessing a real locational advantage would be desirable from the point of view of the national economy.

While the high degree of industrial concentration in Official Territory does not rest on such a flimsy basis as a lower level of class rates, the Commission's decision does remove one existing handicap to the growth and development of the South and West. The new adjustment should permit all sections of the country to develop the industries for which they have natural advantages. It should contribute to a sounder regional specialization than we have heretofore had.

This decision will neither destroy the economy of the industrial East, nor will it, overnight, assure the industrial flowering of the South and West. It constitutes one sound step toward establishing that equality of opportunity for all sections of the country which is essential to a nation that bears the proud title of The *United* States.

President, McGraw-Hill Publishing Co., Inc.

Lincoln Urges Simpler Electrode Specifications

In this letter to the editor, J F Lincoln, president of The Lincoln Electric Co, calls present specifications "complicated, impracticable." For mild steel he proposes tests easily made by manufacturer or user. Mr. Lincoln, who has pioneered many campaigns to reduce welding cost and encourage its broader application, has this to say:

J F LINCOLN

▶"Industry in general and the welding industry in particular are and have been greatly handicapped by the lack of a real technical standard covering electrodes.

"True it is, there has been in existence for some years a so-called standard, which actually might be termed a 'buyers' guide,' known as *Tentative Specifications for Iron and Steel Arc Welding Electrodes*, published by the American Welding Society.

"However, even in this long and complicated buyers' guide there are so many discrepancies with ambiguous and contradictory statements that it is rendered entirely unsatisfactory. Let me cite a few examples:

Sample Statements

"To qualify any electrode for any classification, the tests are so complicated and so costly as to render them useless in manufacturing practice. They are too costly to be repeated periodically as a check on manufacturing standards.

"Tests are required on all sizes of 5/32 in. and above. But note: No tests are required on 1/8 in. and smaller, so why have tests on *each* larger size?

"A manufacturer cannot use the same electrode for two or more classifications —this in spite of the fact that the ideal electrode, of course, is one that would fulfill all classifications.

"Then there are specifications as to the electrical resistance of the coating, which certainly has nothing to do with the performance of the electrode.

"Also this so-called standard says: 'The coating shall not have scabs, blisters, abnormal pockmarks, bruises, or other surface defects that shall be injurious.' Just what is 'injurious?'

"These are only a few of the idiosyncrasies of this buyers' guide. Therefore, it can readily be seen that what is needed is a simple, easily understandable specification that would permit manufacturing to such a standard consistently and would enable the purchaser to test the electrodes readily and easily if he wished to do so, to see whether the manufacturer was conforming to the standard.

"Since there is no need for a weld stronger or better than the material to be welded, I suggest for mild steel, which covers 90% of the requirements, a simple standard, something as follows:

"The electrode shall be of such characteristics that it will withstand the following tests to be made any time a buyer might desire:

"(a) A weld made in 3/8 in. or 1/2 in. plate of mild steel, planed to the same thickness as the parent metal, must break outside of the weld when pulled in a standard tension machine.

"(b) On a section from the same plate mentioned in (a), welds to be bent in any way desired and elongation of 25% in the outside fibers must show no fracture.

"It is quite evident that an electrode that will perform as indicated in these two tests will give a weld equal in physical quality to the plate.

"With such a weld, obviously the matter of porosity is of no consequence. However, if it should be desired to cover the question of porosity, a simple test could be made as follows:

"A fracture shall be made through the weld. On a straight line through the fractured weld there shall be voids of no more than 5% cumulatively.

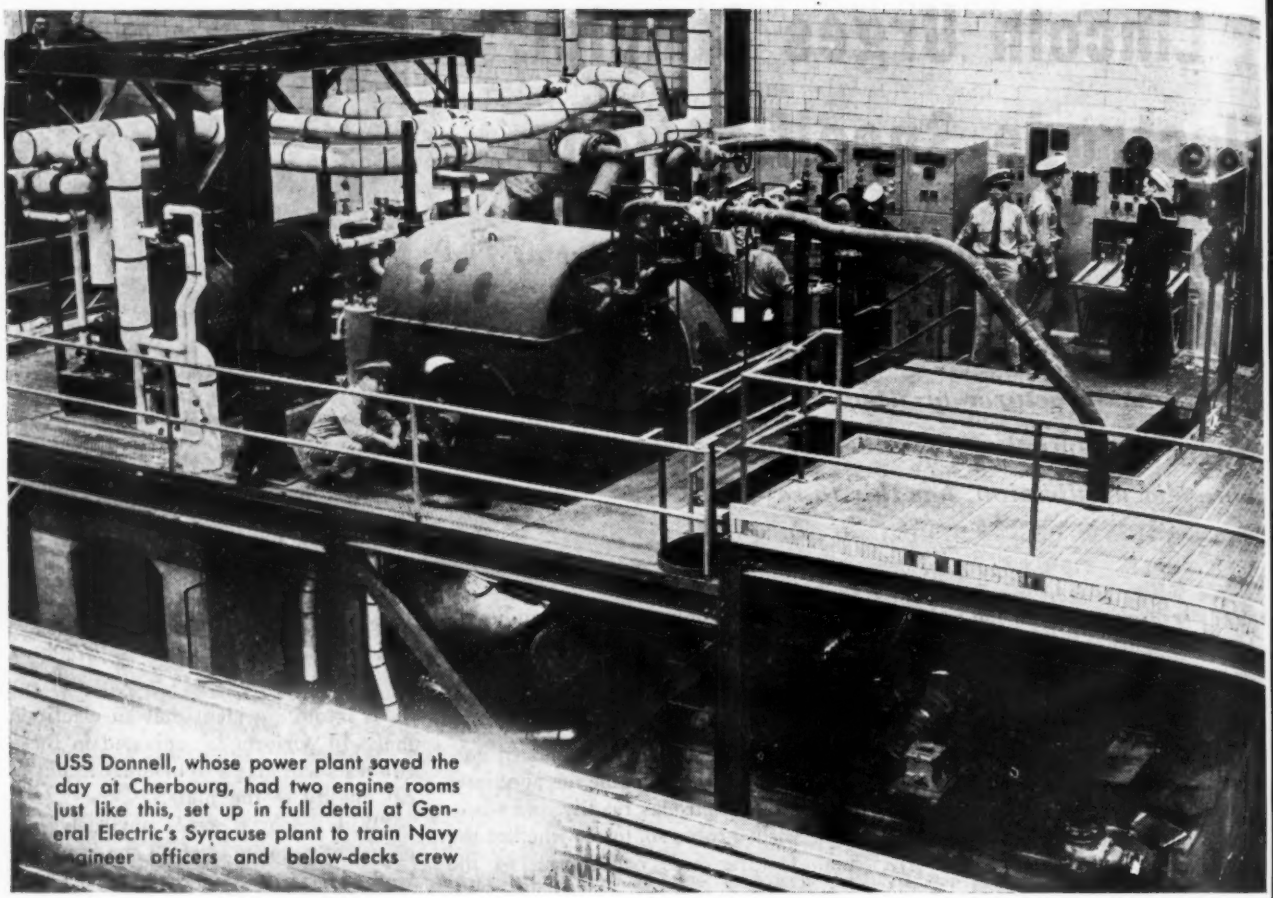
"There is no question but that an electrode that will withstand the above very simple tests will be satisfactory in welding mild steel. So why complicate matters?

"It seems to me that this is a question to which the Filler Metal Committee of the American Welding Society, 33 West 39th St., New York City, should give proper attention."

ARE YOU PLANNING TO DO YOUR PART?

Paper is a No. 1 war-material shortage because over 700,000 different war items are wrapped, packaged, labelled, tagged or made from paper or container board. The Pacific war will require stupendous amounts of paper and board since double and triple packing are required for protection against weather, insects, etc.

So please: (1) Share this magazine with your associates. Because of the paper shortage, the number of copies is limited. (2) Organize for a continuous drive in office and plant to collect waste paper of any kind to put into paper salvage. Clean out old files, dead correspondence, obsolete records, useless display materials, cartons, etc.



USS Donnell, whose power plant saved the day at Cherbourg, had two engine rooms just like this, set up in full detail at General Electric's Syracuse plant to train Navy engineer officers and below-decks crew

Destroyer Escort Lives Again

Taking in stride little things like lack of drawings, language difficulties, voltage and frequency differences, Navy engineers went to work on a crippled warship and an abandoned transformer. Lt J L Hart, USNR, tells how Yankee ingenuity licked a power shortage that threatened our offensive

▶ BEFORE THE U. S. FORCES occupied Cherbourg in June, 1944, all power for the port and vicinity had come from the central power plant at Caen, some 45 miles distant. Previous to withdrawing from Cherbourg, the Germans severed the 33,000-v transmission line and left the area entirely dependent on a local standby plant of very limited capacity. This plant, consisting of two old steam turbine-generators each rated at 900 kva, 5000 v, was ordered disabled by the Nazi commander; but the local plant manager prevailed upon a German officer to spare the equipment that the city might have light, power and water.

Allied occupation of the port had greatly increased power demands on the already inadequate plant. Funneling of a great part of the supplies for the American armies through Cherbourg added to the burden. One night, early in August, when only one of the generators was on the line, overloading burned it out. The confused engineer on watch threw the entire load on the second unit thereby destroying it also. This deprived the whole Cherbourg area of light, power and water except a few scattered points where emergency diesel-generating sets of 54 kw and 75 kw were hurriedly pressed into service. These units could supply only the hospitals, the communications office and the waterfront lighting systems where Army stevedores were feverishly working 24 hours a day unloading supplies.

After surveying the damage, the French authorities estimated that repairs could not be made in less than eight to ten weeks; actually it took four months. Army and Navy engineers reported they were unable to replace the generators even temporarily and all they had to offer were a few more diesel sets. At this point Rear Admiral John Wilkes, USN, intervened and suggested a possible remedy. Recalling how the aircraft carrier *Lexington* had once supplied the city of Tacoma with power from her main drive generators during an emergency, the admiral stated he had in the British Isles a crippled turbine-electric-drive destroyer escort. A few weeks previously a German torpedo in the Atlantic had blown off some 60 ft of her stern. Minus all her screws and steering mechanism, the ship had been towed into a British port where

Ruined Nazi fortifications look down on Cherbourg's bomb-scarred buildings with drydock and harbor, shown at upper center

to Power Allied Cherbourg Drive

she had been stripped of all ordnance and navigational equipment and was awaiting final disposition or further salvage. Fortunately her engine-room equipment was in good condition.

That the little ship had ample generating capacity was certain, but whether she could supply the power requirements of the Cherbourg system was another matter entirely. Distribution voltage in the city was 5000. Maximum voltage of the two marine alternators on the vessel was 2800 at a frequency of 93⅓ cycles. This compared with the French system, which was designed for 50 cycles. When operating at this speed the alternators had a voltage of about 1500 v. To bring this up to the distribution voltage a transformer with about a 3-to-1 step-up ratio would have to be found.

In the whole peninsula, the only undamaged transformer was a new one the Nazis had installed in the French Naval Arsenal at Cherbourg a few months before. The Germans had either missed the unit in last-minute sabotage, or thought the Allies could find no use for it. Of German make, the only other information the French engineers possessed was that it had been used to reduce the 33,000 v of the Caen transmission line to the 5000 v of the Cherbourg distribution grid. With a 6-to-1 ratio the transformer was unusable with the ship's generators. Only information available was on the name plate in German, which no one present could read. Efforts to work out a usable hookup were further complicated by the French and American engineers' inability to understand each other's language. The American technicians' only hope was to open the transformer and search for a mid-tap.

Speed was essential that the Allied drive might not be delayed. So taking a chance on being able to use the transformer, Admiral Wilkes ordered the crippled destroyer escort, *USS Donnell*, towed to Cherbourg. Luck was with the engineers, who found a mid-tap. The ship was tied up alongside the Cherbourg dock and lines run to the transformer. By manual control of the field excitation the generator output voltage could be increased so that the distribution system had about the normal 5000 v carried. Though the 50-cycle limitation reduced the maximum output to only one third of the rated capacity of each generator, the ship was able to supply twice the power of the burned-out standby plant.

Once in operation the floating power plant carried the load almost without a hitch until the middle of Dec, 1944, when normal service was resumed. There was one time, however, when all did not go well. The frequency had gone up to 53 cycles and the French decided this was unsatisfactory. Without warning they pulled all the switches and took off the entire load. The safeties on the boiler lifted, and so did the boiler itself—almost. That never happened again because thereafter an American sentry stood guard at the distribution board to prevent anyone pulling the switches without first notifying the ship's engineer officer.

Fuel-Equipment Advisers Would Reduce Design Errors

Earl C Payne proposes that fuel producers and equipment manufacturers establish and support regional clearing houses for expert and unprejudiced fuel advice available to all users at nominal cost

Author Earl C Payne, consulting engineer for Consolidation Coal Co, has been a leader in the present crusade for fuel flexibility in boiler-plant design. He says power equipment should be selected to develop full load at good efficiency, burning any fuel likely to become economically available in a given location.

Some time back when Mr Payne stressed this need, Power's editor asked him where the average plant designer or operator could get complete advice relating equipment to available fuels. Mr Payne agreed there is no single adequate source of such coordinated information. This statement shows how he would remedy the situation.

If fuel producers and equipment manufacturers are to undertake this responsibility and expense, they must know whether power men who burn coal and other fuels would use such service if available. Power readers are invited to: (1) discuss need for the proposed service (2) offer suggestions for type of organization, suitable locations, coverage, charges, etc (3) suggest measures to insure user confidence in the service's reliability and impartiality.

▶ In a recent editorial the *Fuel Digest* suggested that fuel producers and manufacturers of fuel-burning equipment establish regional consumer-advisory services to furnish complete engineering information to prospective fuel users and to others planning modernization of combustion equipment. Here is the germ of an important idea.

Existing agencies have, of course, made a start in this direction. For years unbiased expert information has been available from several organizations, and some consulting firms employ fuel experts. At least one large bituminous coal company has a fuel consultation service. The anthracite industry has organized the Anthracite Institute for research and fuel service. Several manufacturers of boilers employ fuel specialists. Bituminous producers in northern West Virginia have organized the Fairmont Coal Bureau.

No One Place to Go

However, few concerns can afford a staff experienced over the whole range of fuel and equipment economics. For that reason fuel users contemplating new construction or plant modernization must now contact several sources for the desired information. Also they may feel that advice from a single manufacturer or fuel supplier is influenced by the source. Free information from trade associations all too often is valued for what it costs. In combining and studying the advice he gets from these various sources, the user often reaches wrong conclusions through faulty analysis.

To establish a fuel consultation service worthy of national recognition and support by all concerned with fuel utilization will probably require organizing an independent firm staffed with engineers who are competent in the fields of fuel economics and power-plant operation, as well as the production, transportation, marketing and utilization of solid, liquid and gaseous fuels. No one man can be expert in all these matters; only a group of closely associated specialists can supply all-round advice on which the expenditure of millions of dollars for postwar modernization of fuel-burning equipment may safely be made.

The great need for such a service should be clear to all, but how can it be made available for a nominal fee? My suggestion is that this fuel consultation service be subsidized at the start by all bituminous coal producers either directly or (preferably) through their associations. The same type of support should be given by the oil companies and the gas companies. Manufacturers of boilers, fuel-burning and related equipment should also be willing to subscribe.

To insure solid planning, and make the work attractive to capable men, support should be guaranteed for the first five years. It seems possible that the organization will become self-supporting as soon as its value has been demonstrated and properly publicized.

With Germany defeated, and Japan on the defensive, the time is ripe to establish such an agency. Almost every industrial and domestic consumer has experienced conversion and substitution troubles and headaches because of wartime fuel shortages and dislocations. Thousands of plants should be modernized as quickly as possible to insure low-cost heat and power. Speed is imperative, yet plant design should always be preceded by an economic fuel investigation to establish the range of fuels for which equipment should be designed.

Because the stakes are tremendous, in terms of future steam and power costs, all concerned with fuel burning should stand ready to support an independent and competent organization in each industrial region to supply unprejudiced advice. If this is done we need not repeat the mistakes of the past when lack of fuel understanding led to inflexible plant designs, suitable only for premium fuels. Many of these plants were obsolete before the first pound of steam was generated. Let's plan now to avoid a new postwar crop of problem plants!

THE OPERATING ENGINEER

George Edwards *Advisory Editor*

PRACTICAL AIDS · MAINTENANCE HINTS · QUESTIONS — ANSWERS

PUBLISHED MONTHLY AS AN INTEGRAL PART OF POWER

False Economy Played Havoc With This Heating-System Changeover

Sacrificing engineering design kept expense low but caused trouble later. J D Constance says it never pays to cut corners by omitting devices vitally important to system operation

▶WHEN A 2-PIPE GRAVITY hot-water heating plant was changed to a 2-pipe low-pressure gravity-return steam system, engineering design was sacrificed to make the conversion with least expenditure of money. The 2-pipe steam system was selected because higher emission rates could be realized in radiators and boiler. Originally used as a garage, the space was being prepared for occupancy of ten persons and for storing and shipping office supplies.

The hot-water system had served 20 years, but no piping changes were made, Fig. 1, other than to add the unit heater and its connection. A check showed the piping adequate for the calculated heating load. Piping was uninsulated, to the detriment of system performance. Side-wall radiators, Fig. 2, had no air vents or traps.

The boiler, fired with a manually ignited oil burner without automatic control, was of watertube construction with cast-iron sections, and the piping immediately adjacent was conventional for hot-water heating. Thus, there was no Hartford loop.

An oil burner of the gun-injection type designed to burn 9 gal of No. 2 fuel oil per hour replaced the existing manually ignited unit. New burner was tied in electrically with a pressurestat and space thermostat in series. Nominal steam-pressure rating of boiler was 15 psi but because of its age the safety valve was set to blow at 5 psi. Furnace combustion space was found ample on the basis of 3 cu ft per gal of oil fired per hour. These minimum values would be used only where cost of tearing out and rebuilding the furnace section would be too great and really unnecessary.

Side-wall radiator piping was not changed, Fig. 2. Air vents were not installed, nor were thermostatic traps at each radiator outlet. Note that steam runouts were left connected to underside of steam main.

Piping changes were few. No Hartford loop was installed at the boiler. A steam main supplying the new unit heater was taken off the main riser and run over 100 ft back to that position, Fig. 1. None of the steam mains were pitched or dripped as is usual with a new system. Return line from the unit heater was tied into the main condensate header and a check valve

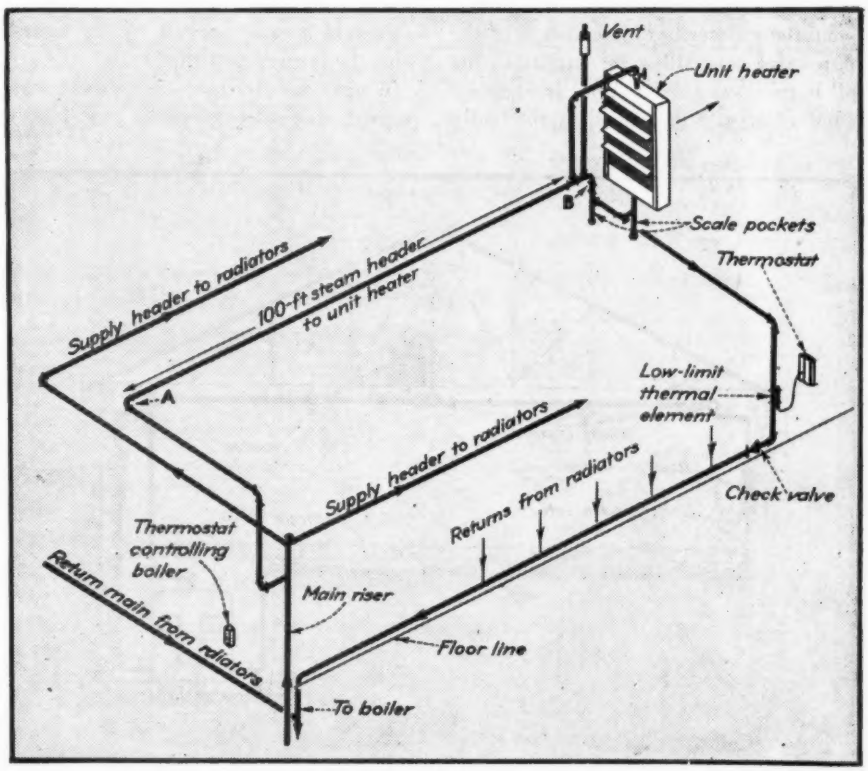


Fig. 1—Two-pipe gravity hot-water heating plant changed to steam operation without considering basic requirements of air release and condensate return

placed in the line at that point. Fig. 1. A low-water cutout was installed at the boiler to prevent damage from low water caused by leaks or water siphoning back to the system. No thermostatic traps were placed in the return line from any of the side-wall radiators, nor was a float-and-thermostatic trap placed in the unit-heater return line.

Also, unit-heater control was installed in such a way that it failed to operate unless a high pressure was maintained on the boiler. The low-limit thermal element was strapped to the return line 50 ft from the heater itself. Control was arranged to cut out the heater if condensate temperature dropped below a predetermined setting on the element. Practically, the return line acted as a cooling leg and the thermal element's lowest setting was not low enough to cut the heater in. The control was not tied into the burner wiring so that even though the unit-heater thermostat called for heat the burner could not operate unless another thermostat, in the same room but 100 ft away, called for heat, too.

As soon as the heating season was in full swing, steam mains became waterlogged and the unit heater delivered cold air. Not only did complaints of *no heat* result and labor trouble threaten, but fuel oil was burned at twice the normal rate for the weather conditions.

Investigation uncovered the piping conditions described and also that the flap valve controlling air supply to the oil burner was closed tight. Incomplete combustion was evidenced by the badly

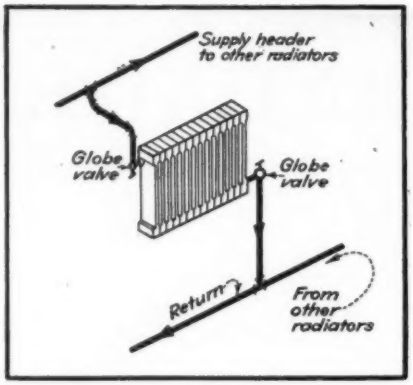


Fig. 2—Side-wall radiators were not provided with traps or air vents

smoking chimney. However, most unusual finding was that the low-water cutout was controlling the burner.

Under these conditions the burner cut in for three minutes, or long enough for the water to fall to the low-water level, and then cut off four minutes, or until the level returned to normal. During this period boiler pressure rose to 2.5 psi then dropped to zero. Steam main to the unit heater became waterlogged and no steam ever reached that device. The radiators, however, received enough steam to keep warm since they were being fed a mixture of hot water and steam. Obviously, the boiler could not hold its pressure long enough to force the collected condensate out of the unit-heater main. The pressurestat did not control the burner although it was hooked up in series with the burner control circuit.

When the burner air valve was opened, efficient combustion took place, water level remained steady, and the boiler ran for longer periods. Steam mains became hot and better conditions existed. Here are the design data with equivalent direct radiation (edr):

Outside temperature	0 F
Inside temperature for 10 hr.	65 F
Inside temperature for 14 hr.	60 F
Edr, calculated	3005
Edr, actual	3192
Divided as follows:	
Side-wall radiators	1052
Unit heater	1200
Exposed supply mains	940

Although actual edr was in excess of that calculated, effect of the former was greatly impaired.

Packing cases shielded side-wall radiators for the most part so that their radiant value was lost to the occupancy although all convected heat was used—but in the wrong places. Because uninsulated supply mains were 15 ft above the floor line much convected heat passed to the space above.

Boiler Capacity Ample

Rating indicated that boiler was just large enough to heat the premises provided no 25% start-up load was added to space requirements. Following changes and services were made to existing conversion:

(1) Boiler and heating system flushed (2) draft control installed in boiler breeching (3) condensate pump installed adjacent to boiler (4) condensate mains sloped toward boiler (5) thermostatic traps put on radiators (6) float and thermostatic trap connected to unit heater (7) unit-heater supply main sloped and dripped at take-off, *A*, Fig. 1 (8) supply main fitted with drip leg just ahead of unit heater, *B*, Fig. 1; also, check valve removed (9) steam mains insulated (10) low-limit thermal element relocated close to scale pocket on unit-heater condensate return (11) vents installed on all radiators and high points in main steam piping (12) Hartford loop added to boiler (13) greater air-intake area provided for combustion air.

Each radiator take-off was left as in the original setup, Fig. 2, because it provided adequate draining of the steam mains without the added expense of pitching and dripping the line.

After making these changes and adjusting the oil burner for efficient combustion, conditions were comfortable and complaints disappeared. Oil consumption was reduced to half its previous rate. Where the oil was formerly fired at a rate of 110 gal per day, consumption now fell to 50.

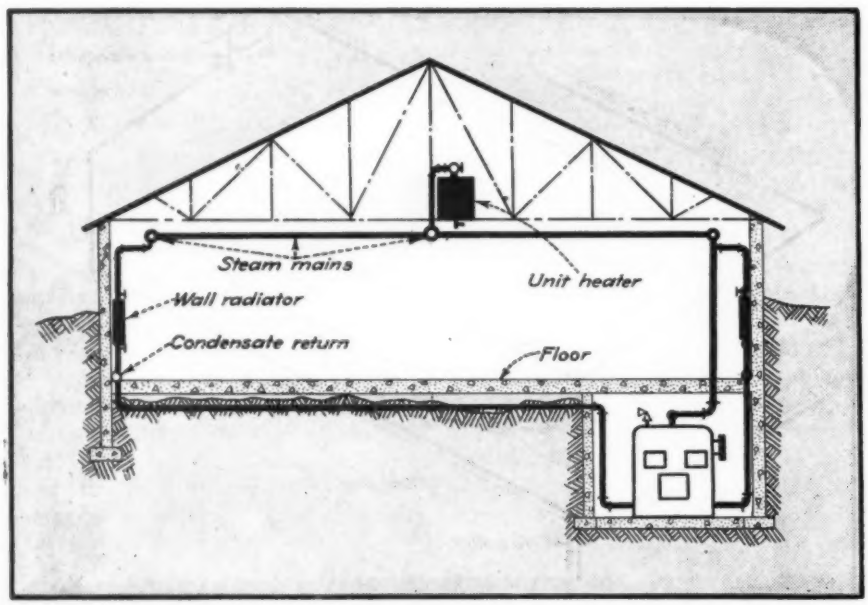


Fig. 3—Piping at the boiler was arranged for a conventional hot-water system. To keep down costs, a Hartford loop was not added for steam operation

REFRIGERATION NOTEBOOK — 24

Devices for Precooling The Liquid Refrigerant

By TERRY MITCHELL, ME, *Frick Company*

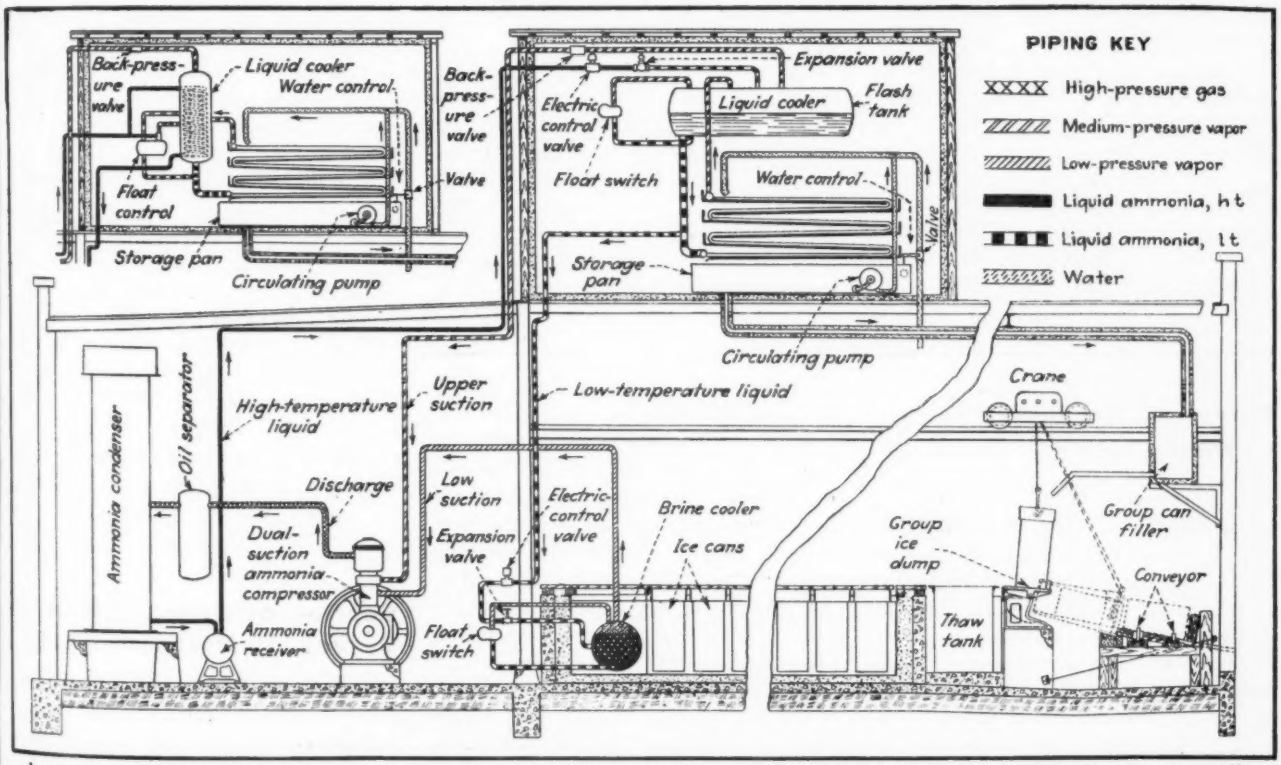
▶LIQUID in a refrigerating system is precooled oftener by passing through coils exposed to the cold suction gas than by any other method. The cooling coil is placed inside a suction return trap or *accumulator*. (All automatic plants should have an accumulator.) If the accumulator coil is wetted or partly flooded by liquid in the returning suction gas, cooling effect on the refrigerant inside is about doubled: Also, the warm refrigerant helps to prevent any excess liquid in the suction gas reaching the compressor as a *slug*. However, the ammonia gas should not be warmed in the accumulator until it is superheated to a great degree, as that reduces compressor capacity.

In the average ice plant, a suitable set of spiral coils in the accumulator should precool the liquid ammonia to within 15 or 20 F of the suction-gas temperature. If the coils are wetted, temperature difference may be reduced to 5 or 10 F—all this provided coils are ample length. Or the coils can be omitted and the liquid fed by a float-controlled valve into the accumulator itself, resulting in so-called *flash* cooling of the liquid before it goes to the evaporator.

Large ice producers find it pays to precool both water going to the cans and liquid ammonia going to the coils or cooler. The diagram shows a typical method with a combination coil-and-liquid bath. Gas from the *flash tank* is often carried to a separate compressor, carrying a somewhat higher suction pressure, or is admitted as *high-pressure suction* to a dual-pressure machine. Such a plan gives a definite thermodynamic advantage while single-stage precooling usually gives only an operating advantage—cooling coils staying more nearly flooded.

This arrangement is carried one step farther in cooling the liquid for a low-temperature job such as quick freezing. The shell is now made vertical, and kept filled with liquid to a higher level by a float control. Discharge gas from the first stage or booster machine passes through an intercooler, using cold water, and then is bubbled up through the liquid bath (POWER, July, 1943, p 105). Size and design of such a gas-and-liquid cooler must be engineered to carry the load, or full benefits will not be derived. An 8¾x6-in. booster with two cylinders working on a 40-ton load requires a gas-liquid cooler about 8 ft high and 16 in. diameter, with 45 ft of 1¼-in. pipe inside. A 4-cylinder 17¾x12-in. booster calls for a cooler 8 ft high by 36 in. diameter with not less than 500 ft of 1¼-in. pipe submerged in the liquid bath.

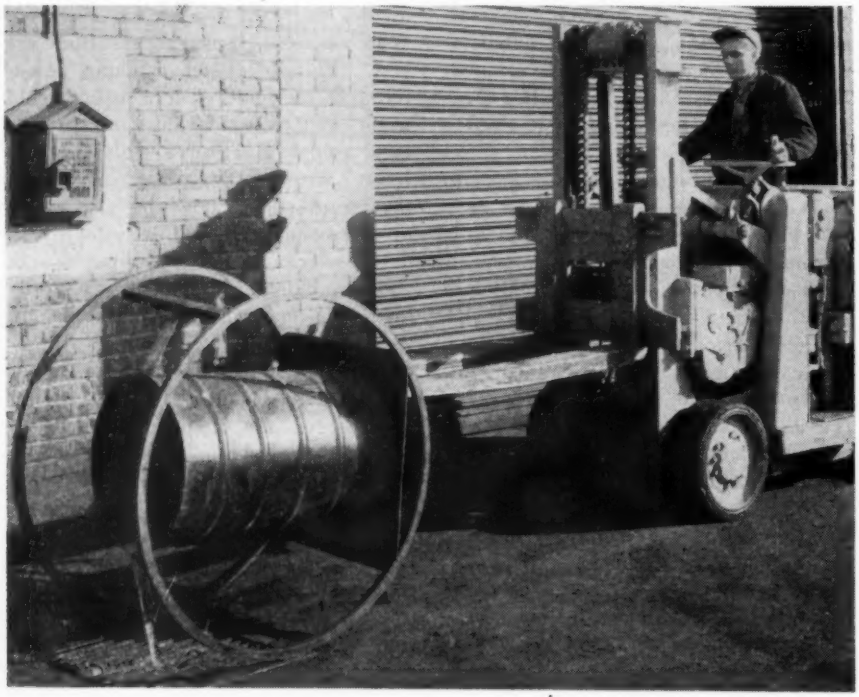
Low-temperature systems with several stages have a gas-and-liquid precooler between each stage. These intercoolers contribute materially to the savings (up to 25% or more) possible with booster compressors as opposed to straight compression without heat exchangers.



Large ice producers find it pays to precool water before filling cans, and liquid ammonia before it goes to coils

PRACTICAL AIDS TO OPERATION

Plant-Tested Methods and Ideas for Power Men



ROLL-OVER DRUM DISPOSES OF REFUSE

FLOYD BLIVEN, salvage supervisor at General Electric's Erie works, developed this roll-over drum which easily disposes of wet grinding sludge, and similar waste. An open-top drum welded to a metal base plate is framed with two metal hoops, held by angle-iron braces.

The drum is easily transported by an electric fork truck from various machines to the drain. After lowering the drum to the ground, the operator moves the truck back until the fork tips are under the edge of the base plate. As the forks are slowly raised, the drum rolls over and the waste is emptied, as the photo shows. The drum is automatically returned to an upright position by the weight of its base.

Lineshaft Breaks In Pulley Hub

MUCH HAS BEEN SAID about locating lineshaft bearing hangers at pulleys to take the load and reduce shaft deflection. However, millwrights frequently disregard this simple rule and as a result get into trouble. A pulley on one of our lineshafts was located about midway between two bearings. After about two years' operation the shaft failed in the pulley hub. After this happened we installed a bearing at the pulley.

The cause of the failure is quite simple. The pulley hub is secured tightly to the shaft. The hub and shaft form a rigid section that cannot bend with the rest of the shaft. As a result, as the shaft deflects because of tension in the belt, it is free to bend except at the pulley hub. Here it is held straight and rigid. This causes a sharp bend in the shaft at the end of the hub that produces high stress concentration in the shaft.

These stresses reverse and repeat with each revolution of the shaft, causing the metal in the shaft to fatigue, at the hub and break. The break most always occurs in the pulley hub and seldom in a bearing. The shaft has considerable clearance in the bearings which helps to distribute any stresses due to its deflection. When a bearing is placed at the pulley it takes the load and prevents the shaft being deflected.

A lineshaft badly out of line may break where the greatest concentration of stresses occurs. This happens in much the same way that the shaft breaks in a pulley hub.

Detroit, Mich. L R CARRY

Heat in Conduits Caused by Eddy Current

WHEN SEVERAL LARGE CONDUCTORS are required to supply a 3-phase load sometimes the mistake is made of putting the conductors of each phase in a single conduit, as was done in one plant where I worked. Four 300,000-cm conductors were installed for each phase to connect the 3-phase transformer's 110-v secondary to busbars. The four conductors of each phase were grouped and each of the three groups run in a conduit. When the system went into service the conduits became very hot at times of heavy loads.

Everyone assumed that the heating was caused by eddy currents induced in the conduits, but nothing was done about it until we had to rearrange the busbars. We then installed an extra conduit and pulled three wires, one from each phase group into each of the four conduits. This eliminated the heating of the conduits and showed that the trouble was caused by the single-phase conductors inducing eddy current in the conduits of the original arrangement.

Philadelphia, Pa. R O SPENCER

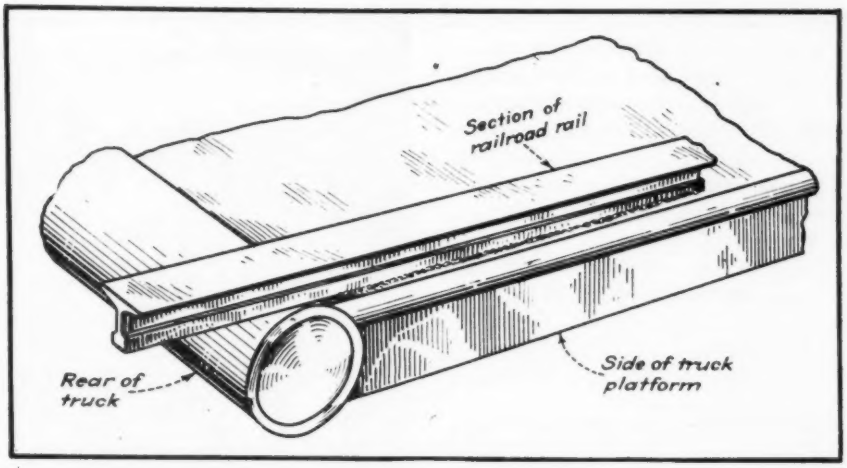
Section of Railroad Rail Serves as Portable Anvil

MAINTENANCE FACILITIES outside the plant frequently call for a truck equipped for welding. Often the welder needs an anvil on a more or less rigid mount-

ing. One power company contractor met this need by welding a short section of scrap railroad rail to the side member of a steel truck platform, letting the rail project far enough to afford clearance for crimping or end bending, as in the drawing.

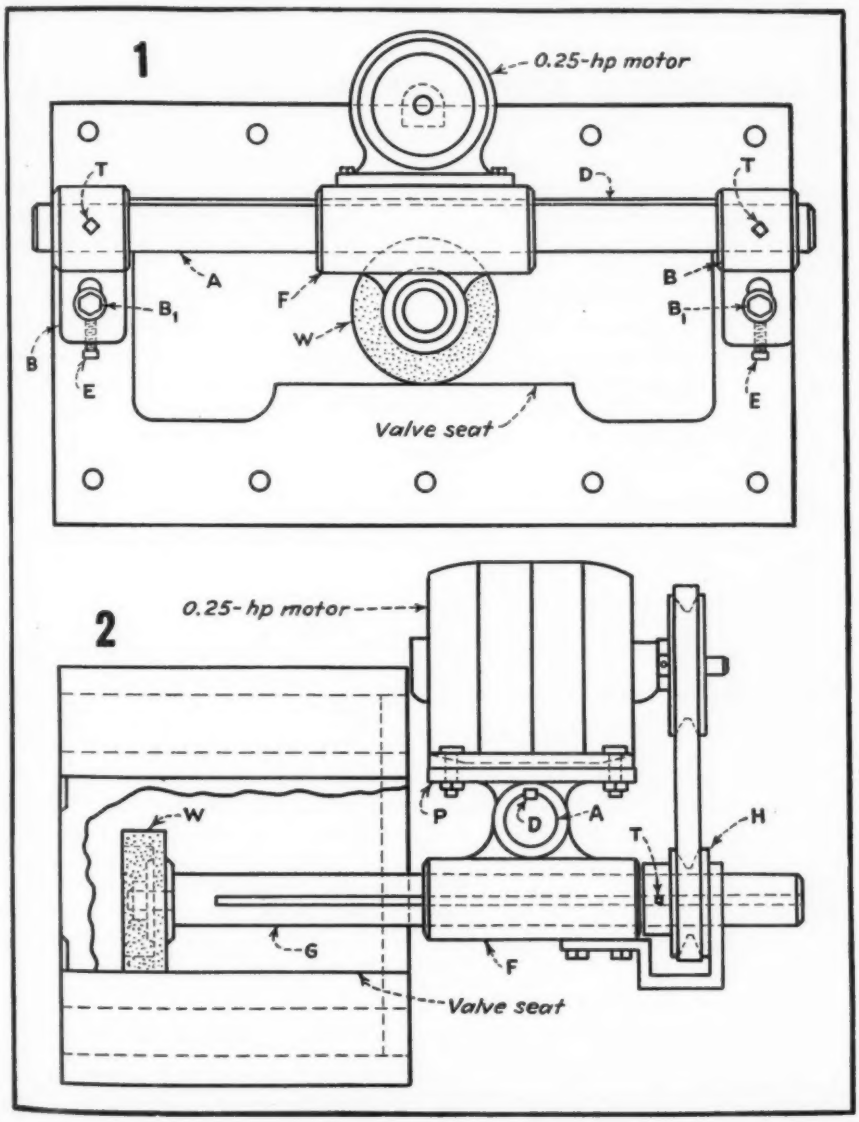
The rail, welded head down, gives a long flat surface on which to straighten stock, while the straight edge of the rail permits flanging of light sheet or strip stock. Being welded to the side of the truck platform, the rail anvil is clear of the normal hauling surface, and may be used to anchor heavy equipment against side shifting.

Houston, Texas CHARLES C LYNDE



THIS HOMEMADE GRINDER CONDITIONS VALVE SEATS

VALVE SEATS became badly scored on two adjustable-speed twin engines. It would have been an expensive job to remove their cylinders and send them to a machine shop to resurface the seats. We therefore designed and built a valve-seat grinder and trued them on Sundays during the regular weekend shutdowns. Fig. 1 and 2 show the grinder in place on the valve chest.



In Fig. 2 the sliding assembly *F* consists of two pieces of cold-rolled steel welded together at right angles and bored out for a sliding shaft and grinding-wheel spindle. To support the driving motor we welded a ½-in. steel plate *P* on top of the assembly. We supported sliding assembly *F* on a piece of 1⅛-in. shafting, *A*, Fig. 1 and 2, held from turning in two bearings *B* by setscrews *T*. Base of each bearing is slotted and held to the valve chest by a bolt, B_1. An adjusting screw *E* in each bearing permits leveling shaft *A* and moving it vertically to adjust the thickness of the grinding-wheel cut. Shaft *A* has a key *D* to hold the grinding equipment in position while it is moved from one end of the shaft to the other.

Grinding wheel *W* is attached to one end of a 1⅛-in. shaft, *G*, Fig. 2. This shaft goes through the bottom hole in the sliding assembly and has a V-grooved pulley *H* on it. This pulley fits on a loose key in the shaft and is tightened in place by a set screw. A V-belt connects the grinding wheel pulley to a 0.25-hp motor pulley. Pulleys have a ratio of 2:1 to give the grinding wheel a cutting speed of about 3000 ft per min.

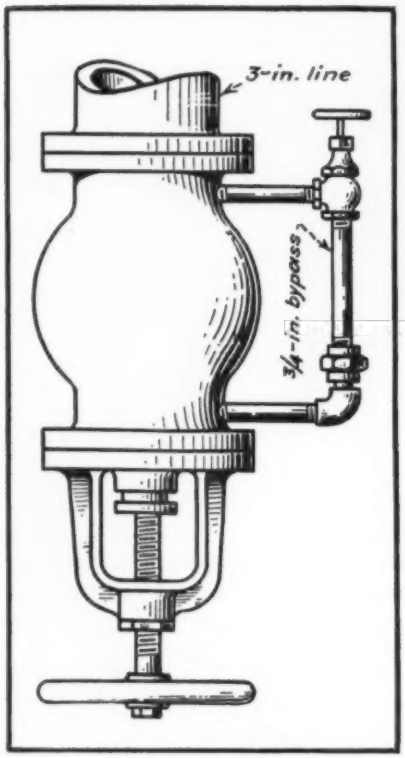
To set up the grinder, shaft *A* is first leveled horizontally and then turned to bring the grinding wheel shaft level and shaft *A* locked in its bearing with set screws *T*. The set screw in the grinding-wheel pulley *H* is loosened and the wheel moved to a position to take the first cut, and the pulley tightened to the shaft with its set screw. Then, the height of the wheel is adjusted for cut depth by screws *E* in the bearing bases, at the same time keeping shaft *A* level.

With the grinding wheel running, the sliding assembly is pushed by hand

along shaft *A* to make the first cut. When this cut is completed, set screw is loosened in the pulley and the grinding wheel shaft moved endwise about the width of the wheel to take the next cut. These operations were repeated until the whole valve-seat surface was ground true. Final finishing of the surface was done with a fine file.

Each valve seat had an area of 8x10 in. and required about 8 hr to grind and put in good condition.

Thorold, Ont. G BARRETT

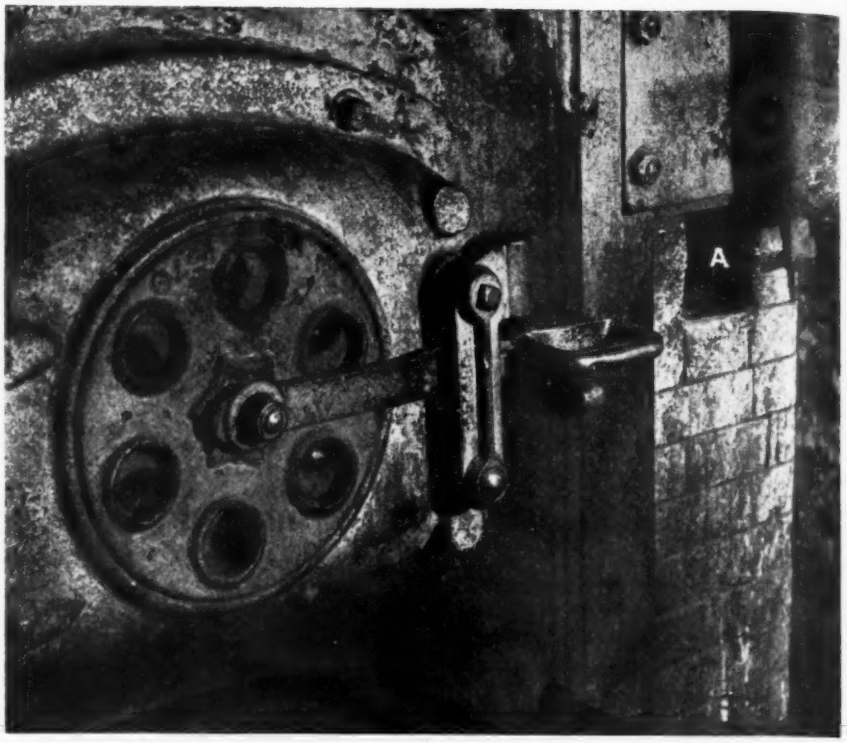


Valve-Seat Wire Drawing Is Reduced by Bypass

IN ONE PLANT where I worked the steam-engine-driven forced-draft fans had to operate for long periods at slow speed. Speed adjustment was obtained by adjusting the opening of the main throttle valve. As a result the valve seats began to show the effects of wire drawing. To eliminate this condition we installed a ¾-in. bypass with a valve around each throttle. During light-load periods we closed the main throttle valve and operated on the bypass.

When more power was required from the engine than could be obtained through the bypass we closed it and opened the main valve. This permitted us to operate the throttle valve sufficiently open to prevent wire drawing on their disks and seats.

Flushing, N. Y. S M ELONKA



AIR COOLING STOPS REFRACTORY TROUBLES

WE WERE HAVING SOME TROUBLE with brick work along the fire line in the furnaces of our hand-fired boilers. Several years previous to this I had some experience with air-cooled tile in the bridgewalls of several furnaces. The bridgewalls were built with a duct back of the tile. This duct extended the width of the furnace and out through the sidewalls to the atmosphere. Minus pressure in the furnace pulled air in through the duct and through holes in the tile. This overfire air helped to protect the bridgewall and improved combustion efficiency a small amount.

With this experience as a guide I decided to put a row of air-cooled blocks along the side walls and bridgewall of each furnace in the plant where I am now working to see if it would not correct our refractory troubles. These blocks form a duct just above the grates in the side walls and bridgewall. This duct terminates in an opening to atmosphere at each corner of the furnace in its front wall, as at *A* in the photo. These blocks have been installed for over four years without requiring attention, but are located where they are likely to be hit by the fire-cleaning tools. When we have to renew the blocks I plan to put two rows of erosion-resisting brick below them to raise the air-cooled tile about on a level with the top of the fire.

Ramsey, N. J. R W RIORDAN

Shaft Deflection Is Increased When Running

YEARS AGO we hired a likely young fellow on an erection job. He had only a year or two of high school but was bright and had an inquiring mind, and therefore acquired skill rapidly. Later he got a job with one of the large operating companies and advanced to superintendent of their water-power stations. While visiting me not long ago, he told the following story:

"I was told every horizontal shaft had a deflection due to its weight and the parts attached to it. I agreed, but when they went on and claimed this deflection remained constant up to operating speed, I didn't believe them. It seemed to me that some, if not all, of the standstill deflection must spin out as the unit came up to speed. Luckily I was cautious enough to keep my opinions to myself until I had proof they were wrong.

"Some time later I had a unit to repair and decided to prove my theory. This unit consisted of a horizontal double-runner waterwheel connected to an ac generator, one of several similar units in the same power station."

"What did you do?" I asked.

"I arranged heavy cribbing in the

wheel casing between the runners. On top of this cribbing I lag-bolted an inverted U-shaped flat-iron bracket with a prick-punch mark directly under the shaft. I then adjusted my inside micrometers to the space between the prick-punch mark and the shaft and connected this generator to another unit also at rest.

"After I put field on both generators, I had the operator bring the combination to speed by hand control of the wheel supplying the driving power, with me and my mics inside the wheel casing. The windage nearly blew my hair and clothes off, but I sat there all agrin, to prove my point. When they signaled to me that the unit was running full speed, the micrometer not only lacked the clearance I expected, it wouldn't go under the shaft. Boy! was I glad I'd kept my big mouth shut!"

Schenectady, N. Y. N L Rea
General Electric Co

FLASH TANK IMPROVES HEATING OPERATION

Plant expansion and production changes created an inefficient condition in our process-heating system. Before the war we had two plants adjacent to each other. When plant No. 2 was built it included a 125-psi boiler installation, which connected by a 125-psi header to the main boiler plant in building No. 1. In No. 2 plant 125-psi heaters were installed that were trapped at 50 psi into a water-softener and heater, Fig. 1.

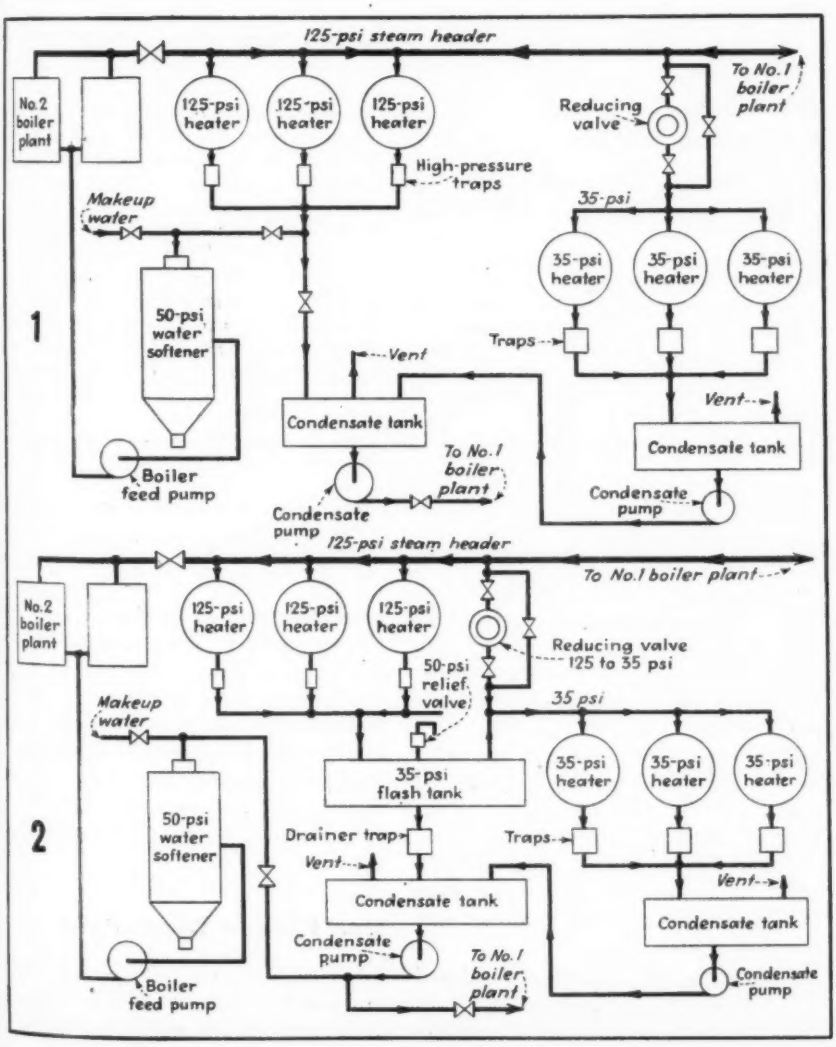
No. 2 boiler plant was installed as a standby for No. 1, but changes in production made it possible to take care of all steam requirements from No. 1, and No. 2 was shut down. When No. 2 boiler plant with its water softener was shut down the 125-lb heaters were trapped to a vented condensate tank, Fig. 1, and the condensate pumped back to boiler plant No. 1.

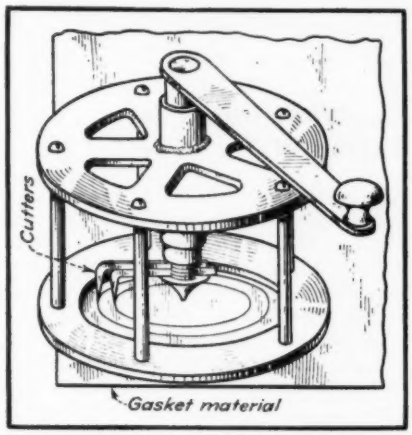
Another plant, No. 3, was built near No. 2 and equipped with 35-psi heaters. Condensate from these heaters drained to a separate condensate tank from where it was pumped to the condensate tank in No. 2 boiler plant. From this tank all condensate was pumped back to No. 1 boiler plant. We realized that considerable heat was lost by flash steam passing out of the condensate tank vent. Fig. 2 shows the changes we made to correct this condition.

We connected the high-pressure-heater drains to a flash tank that flashed to the 35-psi header for the other group of heaters. The 35-psi heaters drain to a condensate tank as before and this condensate is pumped to the tank to which the flash tank also drains. All condensate is pumped back to the main boiler plant.

We estimate that this change with others in the system saves about $3000 per year in fuel costs. Besides it helps No. 1 boiler plant carry the load without operating No. 2 plant in spite of greatly expanded production capacity.

Detroit, Mich. Richard Brown





Builds Gasket Cutter When Old One Fails

When an over-zealous workman warped our flimsy gasket cutter I made the one in the diagram. Top and bottom rings are old brass valve seats from a duplex pump. Posts between the rings are $\frac{3}{8}$-in. brass tubing with $\frac{1}{4}$-in. screws run through them and threaded into the bottom ring. We knurled the under side of this ring to prevent it slipping on the gasket material during cutting.

The shaft guide we made of cold-rolled steel and brazed it in the top ring. The cutter shaft is also cold-rolled steel with a turning handle brazed to its top end and its lower end tapped for a $\frac{5}{16}$-in. screw. This screw is slotted under its head for the cutter blades and its head is ground to a point to hold the center material of the gasket until the cuts are completed.

Marissa, Ill. George Holman

READER'S PROBLEMS

Exercise your engineering wits by submitting answers to these questions fresh from the plant. Suitable material will be paid for; answers accompanied by sketches or photographs command additional pay

Questions from Our Readers

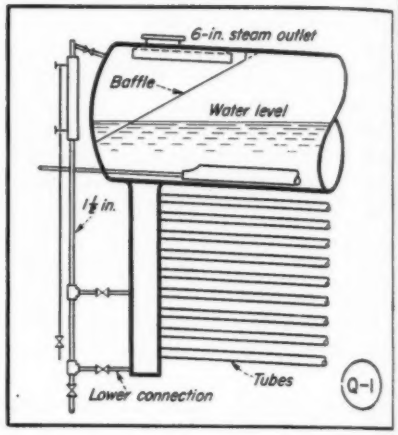
1—What Happens To the Water Level?

STEAM FOR PROCESS WORK at a local plant is supplied by three 250-hp straight-tube boilers. Local water is considered good, containing only 2 to 2½ grains per gal hardness. There is no trouble with priming in other boilers in this city nor any scale accumulation worth mentioning.

Water columns on these boilers, sketch Q-1, have always given trouble. Each time after the gage glass or water column is blown down the water rises to the top of the glass. It falls slowly, usually taking 15 to 20 min to reach normal level (normal is 4 in. in the glass).

A year ago, the second lower water-column connection was installed against my recommendation. Pipes, fittings and valves were renewed to assure that no stoppages existed. Upper-column connection is fitted at right angles to the drum as shown. After the change conditions remained as before.

Steam leaving the boiler passes over the baffle top to a separator before reaching the outlet. Is there enough turbulence in this area to create a pressure drop at the water-column connections and unbalance the water level? Would moving the upper connection outside this area correct the trouble? Does upflow in the header affect the lower connection?—*ABQ*



2—Is This Operation Safe?

OUR HOT-WATER COILS supplied with steam at 2- to 10-psi pressure have failed for the third time. Holes in them are ½ in. in diameter. The local plumber, who soldered the leaks last year, does not have time to help us out and we are unable to secure coils.

To keep the unit in service I have reduced the water pressure to 15 psi and raised the steam pressure to 40 psi. Consequently, instead of water leaking into the coils live steam enters the water. Although it creates some disturbance we have plenty of hot water at no noticeable increase in fuel cost.

Will water in the tank boil at 212 F or at a temperature corresponding to the water pressure? If water temperature increases above 212 F will it do any harm? With the system absolutely tight what maximum pressure can build up in the tank by the 40-psi steam, reduced from 100 psi, having contact with the water?—*PAH*

Answers to June Questions

Can Boiler Output Be Increased?

(This is Question 1 from the June issue, with best answers from readers.)

THE SHADED AREA *in sketch, June Q-1, shows a section of breeching I would like to install to connect the two left-hand boilers with those on the right. I also expect to install a damper in the duct at right-hand stack.*

Left-hand stack is 13x175 ft and its breeching connects to two 665-hp boilers. These units develop 1100 hp each at 168% rating with a stack temperature (boiler outlet) of 500 F when burning 10,250-Btu raw screenings on grates and using natural draft.

Right-hand stack, 10x175 ft, now takes care of two sets of boilers, 2 150-hp hrt and 2 511-hp long-drum units. The 511-hp boilers have natural-draft chain grates and develop 1100 hp each. The 150-hp units have flat grates with Roto stokers and develop 200% rating each with forced blast.

Because the 665-hp boilers developed only 1100 hp, I investigated. The 511-hp units are 77% as large as the 665-hp units. Available draft at stack bases is 1.1 in. It is logical to assume that stack-area differences increase gas velocity in the 10-ft stack when burning the same amount of coal on all four units. The 665-hp units evaporate 7.73 lb and the 511-hp ones 7.25 lb per lb of coal. I feel this will equalize and that the 665-hp boiler output will increase when cross-connecting breeching is installed. I would like to have any suggestions on this problem that the readers of POWER *may care to give me, in line with their experience.—TEP*

Use Forced-Draft Fans

MOST PRACTICAL SOLUTION of TEP's problem is to install individual forced-draft fans on his 655-hp boilers.

Using fine-coal screenings as fuel greatly increases resistance of fuel bed to air passage through it, especially if coal has a caking characteristic.

At 200% rating on each boiler, draft loss through the fuel bed is likely to be about 2 in. of water, depending more or less on grate type and nature of fuel. This draft loss through the fuel bed would be countered by the forced-draft fan, leaving the stack to provide draft for loss through boiler and breeching and provide a slight negative pressure in the furnace.

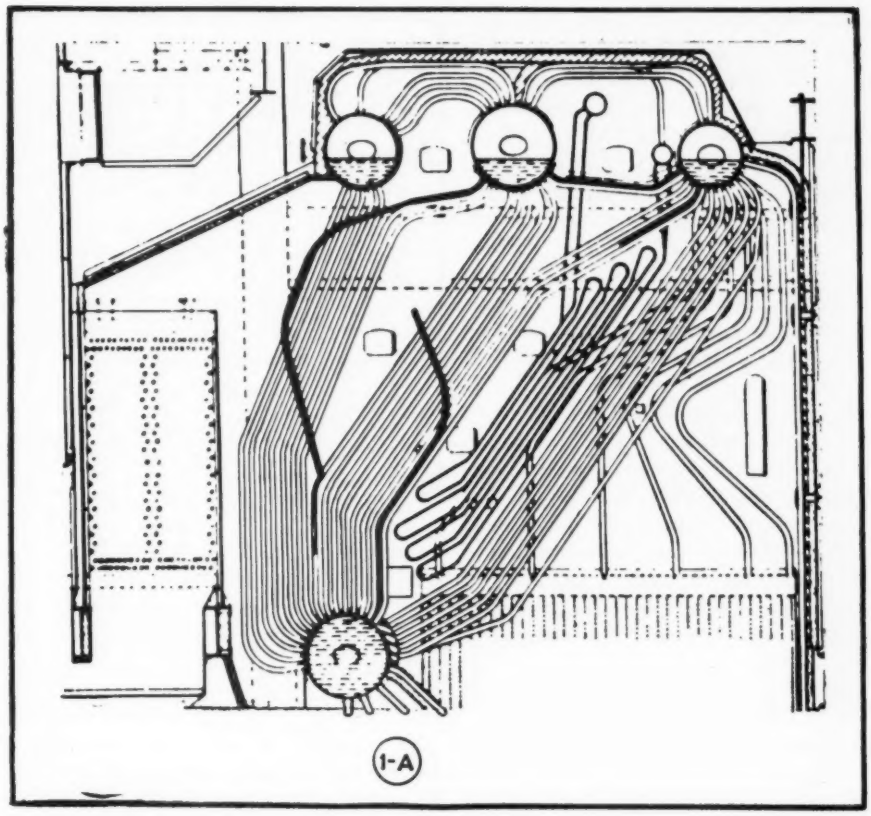
Assuming all draft of the stack (1.1 in. water at stack base) is utilized at 168% rating, necessary draft at 200% rating would be $(200 \div 168)^2 \times (1.1)$ or 1.56 in. of water because draft loss varies as the square of the air velocity, and hence as the air supplied. With a fan, and allowing a negative furnace draft of 0.1 in. of water, the remaining available negative draft of 1 in. water should be ample to offset draft loss through the boiler proper and breeching to obtain 200% rating on each boiler with a 13-ft diameter stack, although draft loss varies widely with condition and type of baffles and cleanliness of passages between boiler tubes.

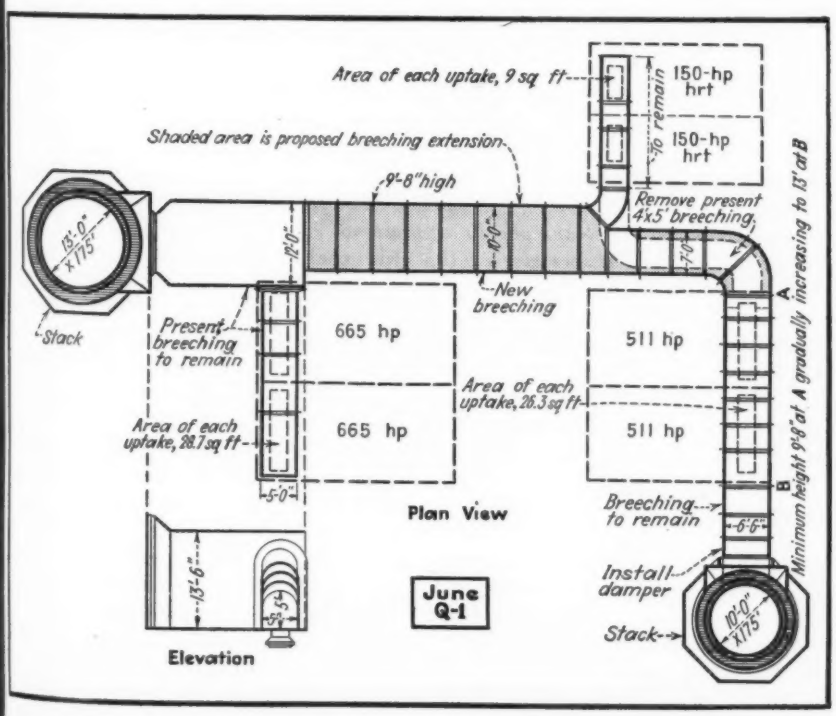
Adding the interconnecting duct, as in TEP's sketch, will further reduce the capacity of the 665-hp boilers because it diverts part of the gas from the hrt boilers and possibly at times some from the 511-hp units. The stoker-fired boilers develop 2500 hp and the 665-hp units a total of 2200 hp so the small stack carries 21% more gas at full load than the large one since $(2500 \div 2200) \times (7.73 \div 7.25) = 1.21$. Assuming air supply to be in inverse ratio to the efficiency and in direct ratio to capacity; this is close if not strictly true.

Draft loss through breeching and stack will be more (in hrt boilers) on the small stack than on the large because of (1) smaller diameter of stack (2) larger volume of gas (3) smaller cross-section of trunk duct (4) one more right-angle turn in the duct at point *A*. Large stack would receive some gas from the hrt boilers and reduce the available draft to the 665-hp boilers by increased draft loss because of greater gas volume.

A forced-draft fan will improve combustion efficiency since less detrimental excess air is drawn in through setting and doors. Baffles should be tight and both sides of tubes clean.

Atlanta, Ga. B D SUMMERS





Rebaffle the Boilers

FROM OUR EXPERIENCE, results would be most disappointing if TEP extended the breeching to increase capacity of the 665-hp boilers.

An examination of capacity tables indicates that present stack will support a 9000-hp plant and, since smallest draft loss is in the breeching, a study should determine cheapest and most promising place to lower the draft loss.

Here it is erroneous to assume that flue-gas velocity from the 511-hp boilers through the 10-ft stack increases the draft and coal-burning rate. Under given conditions this stack is never loaded to 100% capacity, and any increase in flue-gas velocity always increases draft loss through friction.

I believe a draft-loss study of the 665-hp units at 168% rating would show a 0.3-in. loss through the fuel bed, 0.45 to

0.55 in. loss through the setting and not over 0.2-in. loss through the breeching, all of which totals 0.95 to 1.05 in. Greatest improvement can be made in reducing the loss through the setting and fuel bed.

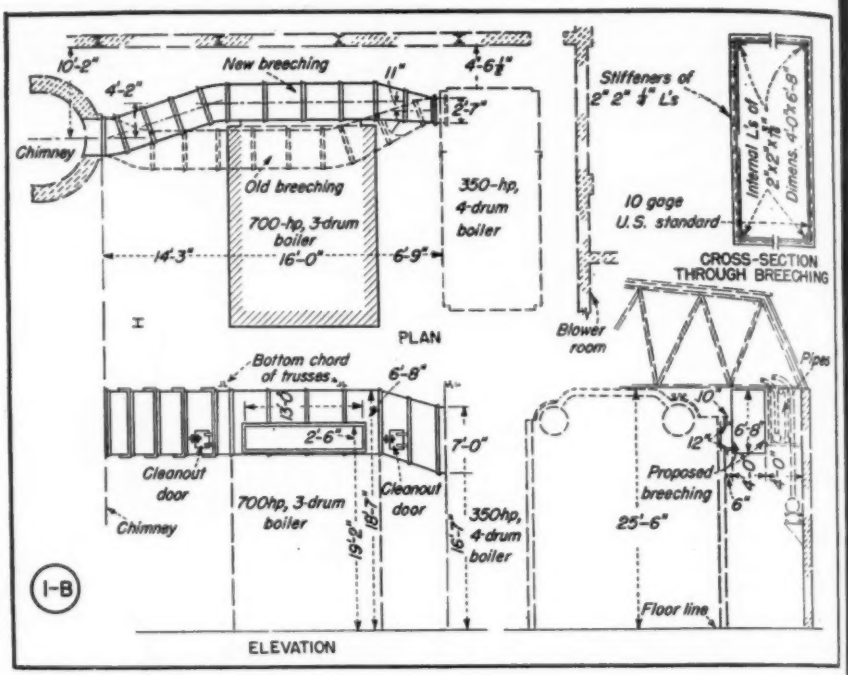
He can accomplish this by (1) rebaffling and installing streamlined baffles, 1-A, page 111. (2) providing forced draft to fuel bed. (Here, 44,000 cfm at 1-in. windbox pressure requires about 15 hp.) (3) burning coal with higher proportion of lumps and higher Btu content.

Rebaffling or providing forced draft will easily increase output of these units to 200% rating. Benefit from changing fuel is problematical, since from the figures efficiency cannot be much improved. Here is our experience in increasing boiler capacity.

In 1937 we installed a 350-hp 4-drum bent-tube boiler, equipped with water-cooled armored bridgewall, slag screen, a 4-retort underfeed stoker, conventional square-tile baffle and set with the mud drum 10 ft above the floor, sketch 1-B. We expected at least 900 hp from this unit but were never able to realize over 600 hp. Draft loss through the setting at this rating was 0.55 inches.

Over the years we considered almost every possibility of increasing the output, such as installing a separate stack, induced-draft fan and enlarged breeching. However, we had sufficient boiler capacity so we did nothing.

In 1942 we removed two old box-header boilers from the space between the 4-drum unit and the stack and installed a 700-hp 3-drum bent-tube boiler equipped with waterwalls, a 6-retort stoker and streamlined baffles. Baffling in this boiler definitely directed the gas across the tubes whereas baffles in the 4-drum unit passed the gas parallel to the tubes.



This 3-drum boiler steams easily at 1800 hp with 3½-in. windbox pressure, 0.05 in. over the fire and 0.35 in. loss through the setting. Flue-gas temperature is well within the range of good practice.

Low draft loss through this unit compared to the 0.55-in. loss at 160% rating through the 4-drum boiler definitely indicated the steps to increase the unit's capacity.

In the summer of 1944 a baffle company installed a streamlined baffle at a cost of about $900, and we are now well pleased with the 900-hp output and 100-F cooler flue gas.

The breeching is 6 ft, 8 in. x 4 ft, and 37 ft long from 4-drum unit to stack, which is 9 ft diameter by 150 ft high. Draft varies summer and winter from 0.65 to 0.8 in. We regularly blow tubes without shutting off the forced-draft fan and no smoke or dust puffs come into the boiler room.

To sum up, stack and breeching were always adequate but the trouble was excessive draft loss and poor efficiency in the 4-drum unit.

Toledo, Ohio F C BECKWITH

Do Old Boilers Warrant Some Repair?

(This is Question 2 from the June issue, with best answers from readers.)

WE HAVE *four 20-year-old boilers and one recently installed, 60,000 lb per hr, fired by a Roto stoker. Old boilers are fired by underfeed stokers.*

I would like to replace two of the old boilers with a new 80,000-lb-per-hr unit. The old settings are in bad shape and so are the stokers. How can I show the management in dollars and cents that a new boiler will produce steam more economically than the old ones? I hesitate to invest money in the latter.

Repairing the old boilers by installing new stokers and adding water walls would be costly and we would still have old equipment. Is the life of a power boiler considered as 20 years? The new unit produces 9.5 lb steam per lb of 13,000-Btu coal. Old boilers give 7.6 lb, per lb coal.

I now believe that George Edwards had the right idea about salesmanship when he said that it is important for an engineer to be a salesman.

I will appreciate advice from other engineers who read POWER.—*HC*

Compare Costs

IN SELLING A PROPOSITION to management it is necessary to get fixed charges —cost of equipment installed—and operating cost, which includes material, insurance, wages and maintenance, for one year to compare the advantage and saving over the present installation.

A new 80,000-lb-per-hr boiler that makes 9.5 lb of steam per lb of coal, with coal that costs $5.00 per ton, would produce steam at 26c per 1000 lb. To produce the same amount at 7.6 lb per lb of coal would cost 32c per 1000 lb. This saving, $14,400 a year of 300 10-hr working days, warrants investing of $144,000 at 10%.

Assuming that the boilers are water-tube units, 20 years is not too old to warrant spending money to make them more efficient. As they now produce only 7.6 lb of steam per lb of 13,000-Btu coal, efficiency is about 56%. By increasing the furnace volume and installing multiple-retort underfeed stokers, efficiency could be increased to 87% to produce 9 lb of steam per lb

of coal. This would save 4c per lb of steam produced, or $9600 per year (300 10-hr days) and warrant an investment of $96,000 at 10%.

New equipment being hard to get HC should have a reputable manufacturer study the situation and submit quotations for new stokers. Capacity and efficiency can be increased by adding superheaters and combustion control.

I know of boilers 32 years old that are in good operating condition. Considering delays in deliveries and time spent on installation I suggest revamping the old boilers and installing new stokers because the boilers will outlive the efficient life of new stokers.

Thorold South, Ont. G BARRETT

Warning in Regard to Lowered Working Pressure

FIRST STEP is to determine whether or not the old boilers, on account of age, are subject to a reduction of allowable working pressure in compliance with Boiler Code rules. If the boilers are operated under such regulations it appears likely that such pressure reduction may be called for.

When presenting the case to management HC could reasonably base his request for new boilers on the fact that the ones to be replaced are 20 years old and he should explain the possibility of having to reduce the working pressure on these old boilers. It would be out of the question to make expensive repairs to boilers that could not be operated at the required pressure.

Even though a reduction in working pressure may not be required at once, boilers of that age could scarcely continue in service for sufficient time to warrant such extensive repairs as new settings and stokers and installation of waterwalls, especially if operated at high ratings.

It seems, from HC's statement, that the boiler he desires to install will equal the capacity of four old boilers, while occupying the space of only two, which might prove a good argument for new equipment.

He should also call attention to the steaming ability of the proposed boiler, which will produce 25% more steam per pound of coal than the old units. Here the saving effected would be about 3800 lb of steam per ton of coal, as in the following figures, which should be of considerable interest to management from a dollars-and-cents viewpoint.

Proposed boiler	9.5x2000. = 19.000	lb
Old boilers	7.6x2000 = 15.200	"
Increase	3.800	"

At the stated evaporation rates, comparison of the old and new boilers could also be made as follows: Old boilers would require $\frac{80{,}000}{7.6 \times 2000} = 5.26$ tons coal per hour and new boiler $\frac{80{,}000}{9.5 \times 2000} = 4.21$ tons coal per hour. Saving by new boiler is 1.05 tons per hour.

This accounts for an output of 3800x 4.21, or 127,784 lb of steam per 8-hr day over what the old boilers could produce from the same amount of coal.

Any further figures obtainable from the operation of the recently installed 60,000-lb-per-hr boiler should provide valuable information on comparative costs of operating the old and new boilers. All discussions of new boiler-plant equipment should keep in view the fact that regardless of extent of repairs to old boilers their age cannot be reduced. Therefore cost of such work would not seem justified as it would all be built around old equipment, rapidly approaching the low limit in depreciation.

Jersey City, N. J. I S CHAMBERLAIN

Repairing the Old Boilers May Save Fuel

TO FIGURE difference in savings between old and new boilers at same output, first determine the efficiency of each:

$$\text{New boiler } \frac{970 \times 9.5}{13{,}000 \text{ Btu}} = 71\%$$

$$\text{Old boiler } \frac{970 \times 7.6}{13{,}000 \text{ Btu}} = 57\%$$

Fuel cost in bunker at $7.00 ton and 80.000 lb of steam per hr at 9.5 lb steam per lb fuel:

$$\frac{80.000}{9.5} = 8421 \text{ lb fuel}$$

$$\text{Fuel cost } \frac{7 \times 8421}{2000} = \$29.47$$

$$\text{Cost of 1000 lb steam} = \frac{29.47 \times 1000}{80{,}000} = 37\text{c}$$

Cost to produce 80,000 lb at 7.6 lb steam per lb fuel:

$$\frac{80{,}000}{7.6} = 10{,}526 \text{ lb coal}$$

$$\text{Fuel cost: } \frac{7 \times 10{,}526}{2000} = \$36.84$$

$$\text{Cost of 1000 lb steam} = \frac{36.84 \times 1000}{80{,}000} = 46\text{c}$$

New boiler consumes 8421 lb per hr and in 24 hr it consumes 8421x24 = 202,104 lb. Old boiler consumes 10,526 lb per hr and in 24 hr consumes 10,526 x24 = 252,624 lb, or an increase of 252,624 − 202,104 = 50,520 lb. Thus the new boiler would save 25.26 tons a day. Burning $7 coal: 25.26x7x365 = $64,539.30 saved per year.

Compare this saving with the cost of the new unit, insurance, interest on investment, depreciation and maintenance against cost of revamping the older units.

New boilers being more compact take up less floor area. But inspect the old boilers to see whether extra cost of revamping is worthwhile, and whether fuel saving would pay for this in a few years.

Port Dalhousie, Ont. G R CREIGHTON

Discuss Problem With Associate Engineers

CONCERNING REPLACEMENT of old boilers with a new one, HC states that the proposed new boiler would evaporate 9.5 lb water per lb of coal as against 7.6 with the old units. This is not a fair comparison because a boiler, regardless of age or design absorbs only as much heat as its firing equipment can supply. Life of any boiler is limited only by the care and maintenance it receives.

Unless there is every reason to believe that the present boiler plant will not meet future requirements, settings and stokers should be reconditioned, making sure that furnace volume and grate area will meet peak demands.

Air discharge from the forced-draft fan should be controlled from steam-header pressure, either by outlet louvers, if operated at constant speed, or by slip-ring motors with external resistance. A damper regulator controlled by vacuum over the fire (0.05 to 0.08) follows the air volume under the fire and materially assists in holding excess to the lowest possible minimum with existing conditions.

If HC has friends affiliated with educational engineering societies, I suggest he ask them to discuss his question at their meetings.

Rochester, N. Y. A GASSMANN, SR

Fuel Saving Will Pay Cost

HC SHOWS GOOD JUDGMENT in planning to replace two of his 20-year-old boilers, rather than embark upon an expensive repair program. Although the life of a boiler is normally longer than 20 years, decision as to when one should be replaced depends on its present state of repair and operating savings that the new installation can effect.

A new 80,000-lb-per-hr boiler is a reasonably sound investment from fuel savings alone. In addition to reduction in fuel costs, there will be savings from reduced operating expense as there will be fewer boilers required to carry the load, less fuel and ashes to handle, and

(*Continued on page* 150)

CENTRIFUGAL PUMP Q AND A FOR POWER ENGINEERS

By I J Karassik and Roy Carter

6—Centrifugal-Pump Classifications

Sixth in a monthly series by Igor J Karassik and Roy Carter, Worthington application engineers. These two experts on centrifugal pumps have selected questions and answers that give a broad, practical understanding of the pumps, their construction, operation, characteristics, troubles and remedies.

Q 1—What is a general-service pump?

A—A number of services use centrifugal pumps of the same construction. For this broad application they are called general-service pumps.

Q 2—What is a booster pump?

A—Any pump that operates in series with another to increase the head or to increase pressure in part of a system is generally called a booster pump. It has numerous applications, the commonest being when water is available under insufficient pressure and a pump is added to boost pressure to that needed. In another common application the required head has been increased to where the existing pump or pumps cannot be used. Accordingly, a booster pump or pumps are added in series to provide the additional head. In some high-head pumping installations, suction conditions do not permit a pump to operate at the best speed for the head and capacity required. To eliminate suction limitations a low-speed low-head pump is installed to take the liquid from the suction supply and discharge it to a high-speed efficient pump that develops the major portion of the total head. In such installations the low-speed low-head pump is a *suction booster pump.*

Generally, a booster pump develops considerably less head than the main pump. However, *booster* is often applied to pumps in intermediate stations of pipelines even though they develop the same or greater head than those in the first station.

Q 3—What location is preferred for a booster pump?

A—When a booster pump has to increase the pressure of a high-pressure pump, it is preferably installed as a suction booster. If it were installed on the high-pressure-pump discharge, its casing and stuffing box would be subjected to high pressure. In many installations this would cause high first cost and a serious stuffing-box maintenance.

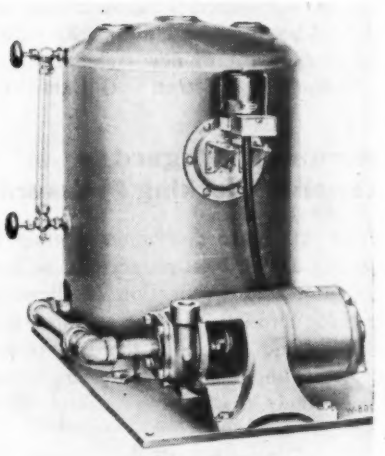


Fig. 1—A condensate-return pump includes a pump, reservoir and control

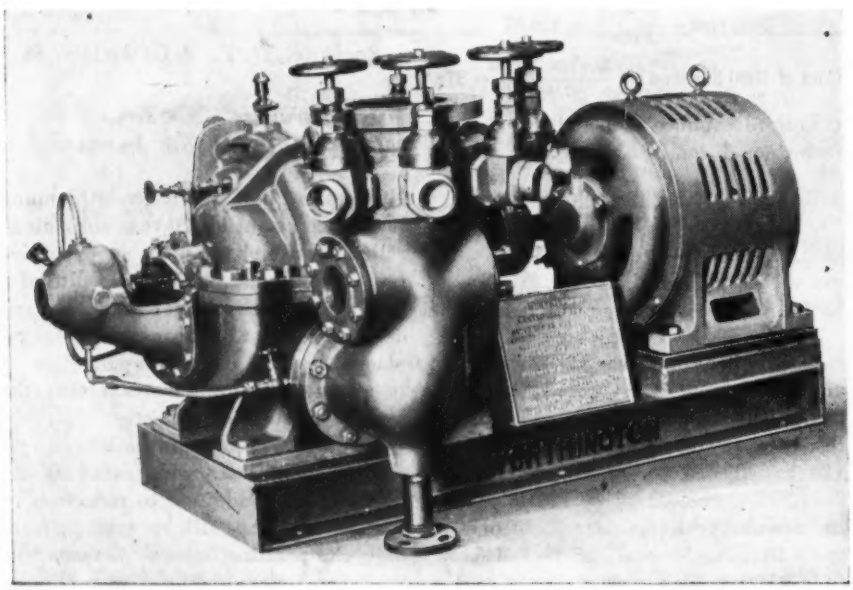


Fig. 2—Fire pump fitted and built to specifications of National Board of Fire Underwriters and Associated Factory Mutual Fire Insurance Companies

Q 4—What is a circulating pump?

A—The term, in the past, was understood to cover a pump to supply cooling water to a surface condenser. So many other applications now exist in which water or other liquids are circulated that this name no longer can be properly used for a single service. It must be qualified by giving the service for which the pump is used, like condenser circulating pump, hot-water circulating pump, etc.

Q 5—What is a boiler feed pump?

A—It is used in steam-generating power plants to deliver feedwater to the boiler. Depending upon the feed cycle, the boiler-feed pump may take its suction from a condensate-pump discharge, a deaerating heater or, in small plants, directly from the makeup source external to the feed cycle. A boiler-feed pump generally handles water at a temperature of 212 F or above.

(*Continued on page* 116)

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PUMP Q&A *Continued*

Q 6—What is meant by a hotwell pump?

A—A pump to take condensate from the hotwell of a condenser, a stage heater or an evaporator and deliver it into the boiler-feed system may be called a hotwell pump. In practice, however, the term has been restricted to condenser hotwell service, other applications carrying their own designation.

Q 7—What is a condensate pump?

A—It handles condensate and, as such, the term could be applied to any pump in a steam-power-plant cycle. Its use, however, is restricted to a centrifugal pump to remove condensate from a condenser. Sometimes any hotwell pump is called a condensate pump, but this is not exactly correct in the restrictive use of the term.

Q 8—What is a tail pump?

A—With low-level jet condensers a pump is required to take water out of the condenser against a head that equals the existing vacuum, plus any external head. These pumps are called tail pumps and are usually of special design mechanically and hydraulically.

Q 9—What is a heater-drain pump?

A—It removes condensate from a closed-heater hotwell. Like all hotwell pumps, it handles liquid at a pressure equivalent to its vapor pressure. Unlike condensate-removal pumps, however, the pumping temperature of a heater-drain pump may be as high as 350 or 400 F, with a corresponding suction pressure, requiring a suitable stuffing-box design.

Q 10—What is a condensate-return unit?

A—The unit is a pump combined with a tank or reservoir and automatic controls, Fig. 1. It is installed so that condensate from various sources, such as a building-heating or process system, can drain to the storage tank. When sufficient condensate has accumulated, the control automatically starts the pump, which discharges the condensate to a boiler or to some part of the boiler-feed system.

Q 11—What is a fire pump?

A—A pump installed solely to provide water to fight fire, which is not used for other services, is called a fire pump. It can be either a regular commercial pump or an especially designed pump approved by the Underwriters.

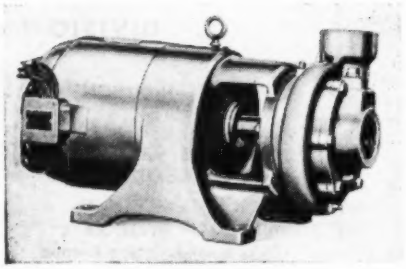


Fig. 3—Close-coupled pump with pump and driver built on a common shaft

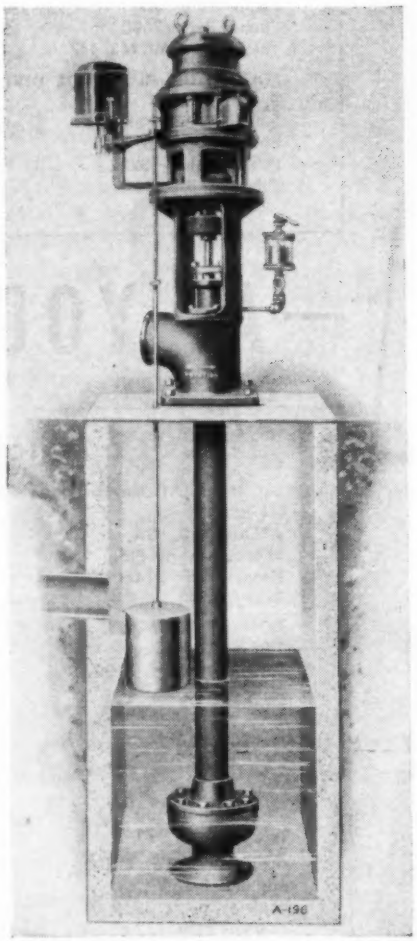


Fig. 4—Vertical wet-pit pump suspended in a sump where drainage collects

Q 12—What is an Underwriters' fire pump?

A—The National Board of Fire Underwriters and the Associated Factory Mutual Fire Insurance Companies have established specifications covering the mechanical-design and hydraulic-performance features for fire pumps. Pumps built to meet these specifications and approved by the Underwriters are called Underwriters' fire pumps, Fig. 2.

Q 13—What are Underwriters' fittings?

A—They are accessories the Underwriters require for use with fire pumps before installation can be approved.

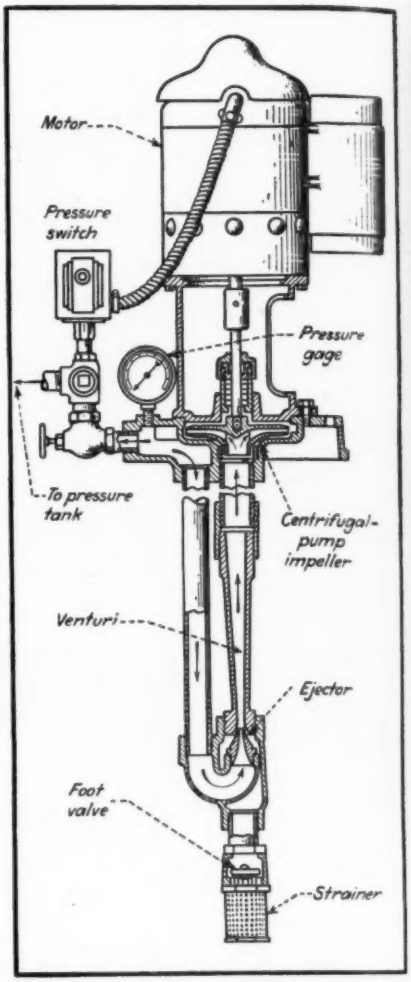


Fig. 5—A jet pump combines centrifugal pump at the well top with ejector below water level in the well

These include pressure gages, air and starting valve, manifold with hose gates, relief valve, etc. Local conditions dictate what fittings must be included to have the installation approved.

Q 14—What is a trash pump?

A—A nonclogging sewage pump was at one time called a trash pump. The term is rarely used now.

Q 15—What is a nonclogging pump?

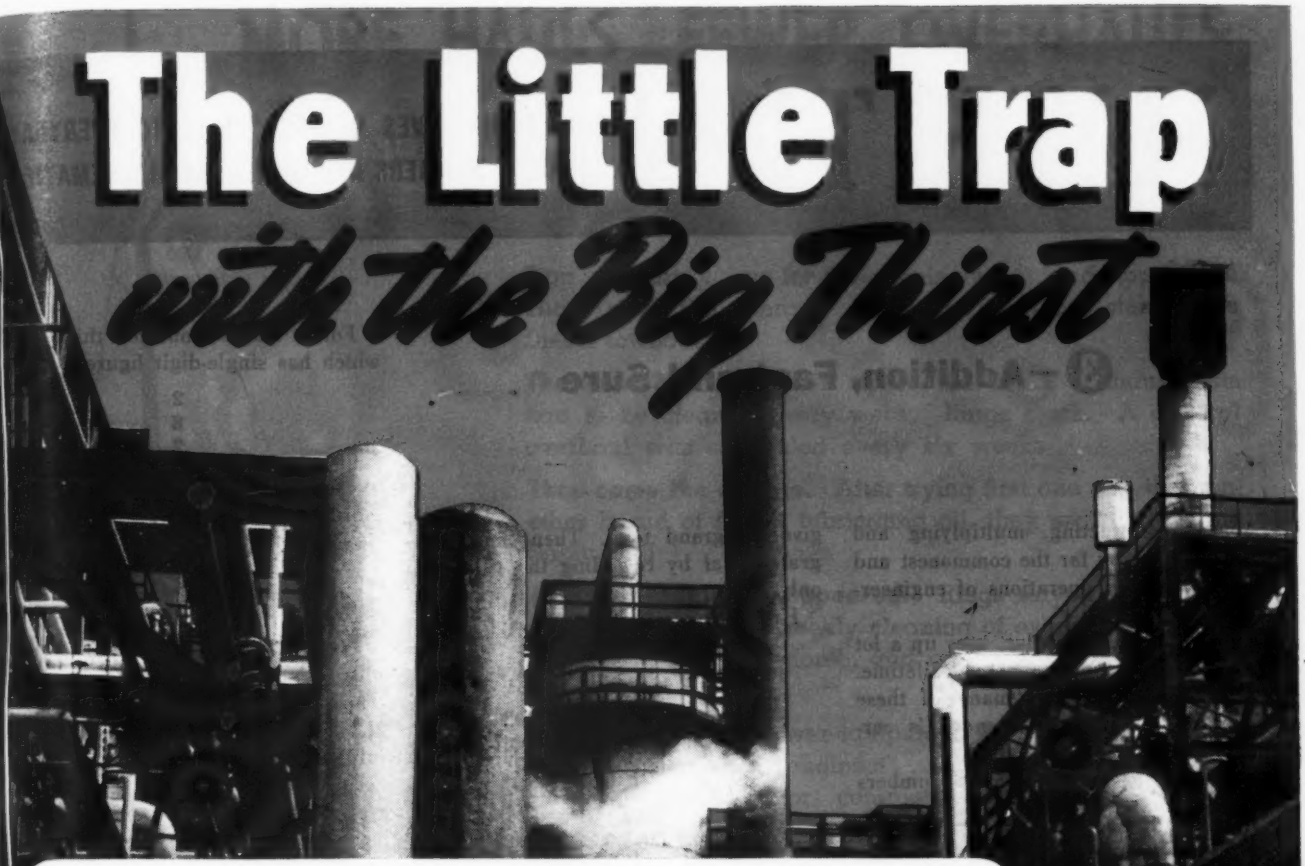
A—It has a comparatively large opening between its impeller's vanes, which are well rounded at their entrance ends, to prevent clogging with strings, rags and solids when handling sewage or other liquids containing matter that tends to clog the impeller. An ordinary centrifugal-pump impeller has comparatively small passages between its vanes, which have sharp entrance ends and are easily clogged when handling such liquids as sewage.

Q 16—What is a sludge pump?

A—Pumps are required in sewage and some water-purification plants and

(*Continued on page* 136)

The Little Trap *with the Big Thirst*



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MATH TIPS

PHIL SWAIN GIVES HELPFUL HINTS TO EVERYDAY USERS OF NUMBERS AND HOMESPUN MATHEMATICS

❸—Addition, Fast and Sure

ADDING, subtracting, multiplying and dividing, are by far the commonest and most important operations of engineering mathematics.

Addition, in particular, uses up a lot of hours in an engineer's lifetime. Learning how to save many of these hours, while gaining sureness, is certainly worth study and drill.

Below is an addition of two numbers as commonly set down:

```
 26.13
415.38
------
Total 441.51
```

Here 3 plus 8 is 11. Put down 1 and carry 1. Then, 1 plus 1 plus 3 is 5, etc. This is the usual procedure and we can't suggest any improvement.

In contrast, try first the customary way of adding a long column of figures:

```
 26.13
415.38
260.41
 22.85
191.06
205.43
 88.55
739.11
263.05
------
Total 2211.97
```

Following the usual procedure, we added the digits in the last column to get 37. We set down the 7 in the last place of the sum and added the 3 to the sum of the digits in the next to the last column, and so on.

This is neither the fastest nor the surest way to add such a column. The longer the column the greater the chance of error. If the check is made on the final sum only, an error discovered in this sum will require repeating the *entire* adding operation.

This is Faster

To avoid this, subtotal each column of digits separately, and check each of these subtotals before adding them to give the grand total. Then check the grand total by re-adding the subtotals only.

Here it is, worked out:

```
 26.13
415.38
260.41
 22.85
191.06
205.43
 88.55
739.11
263.05
------
  .37
 2.6
 39.
 37
 18
------
Total 2211.97
```

First add the single columns working *down*. Then, to check, add them reading *up* to reduce the chance of repeating former errors. At this point put check marks opposite each subtotal as a reminder that it is correct. Then add the subtotals, first reading *down*, then reading *up* as a check.

This principle can be carried a lot further. Suppose an engineer is working out any long series of computations, each of which depends on the one before. A mistake in any step throws out all subsequent steps. To avoid wasting time working on wrong figures be sure to check each step before proceeding to the next step.

Mental Addition

Skill in "mental arithmetic" is cherished not only by school children but even more by chief engineers and bank presidents.

For engineers exact and approximate mental arithmetic are equally important. Later in this series a lot will be said about approximate figuring. This lesson will stick to exact addition done without writing down any totals or subtotals.

For a starter consider this column, which has single-digit figures:

```
2
8
7
4
9
3
2
5
---
Total 40
```

Instead of reading: 2 and 8 is 10, plus 7 is 17, plus 4 is 21, we simply read (silently or out loud): 2, 10, 17, 21, 30, 33, 35, 40. The expert generally skips some of these steps, chiefly by noting combinations that make 10, such as 1 and 9, 2 and 8, 3 and 7, etc. Thus he sees at a glance that the sum of the first three numbers is 17. He may see the 4 and 9 as 13, which added to 17 is obviously 30. Then the 3, 2 and 5 come together in his mind as a 10 to bring the total to 40.

When adding single digits it is often convenient to think of adding 9 as adding 10 and subtracting one, also of adding 8 as adding 10 and subtracting 2, and so on.

All this is pretty well known, but many good engineers and good mathematicians don't get the maximum speed and sureness in mentally adding columns of figures containing two or more digits.

Take the following sum:

```
26
45
33
72
94
16
58
15
24
```

Most men find it takes some concentration to add 26 to 45 and get 71 surely and so on.

To make the job much easier and surer add each of these two digit numbers in two steps. First add the units place, then the tens' place.

You might read it this way: 26 plus 5 is 31, plus 40 is 71, and so on. Better yet, merely recite: 26, 31, 71, 74, 104, 106, 176, 180, 270, 276, 286, 294, 344, 349, 359, 363, 383, total.

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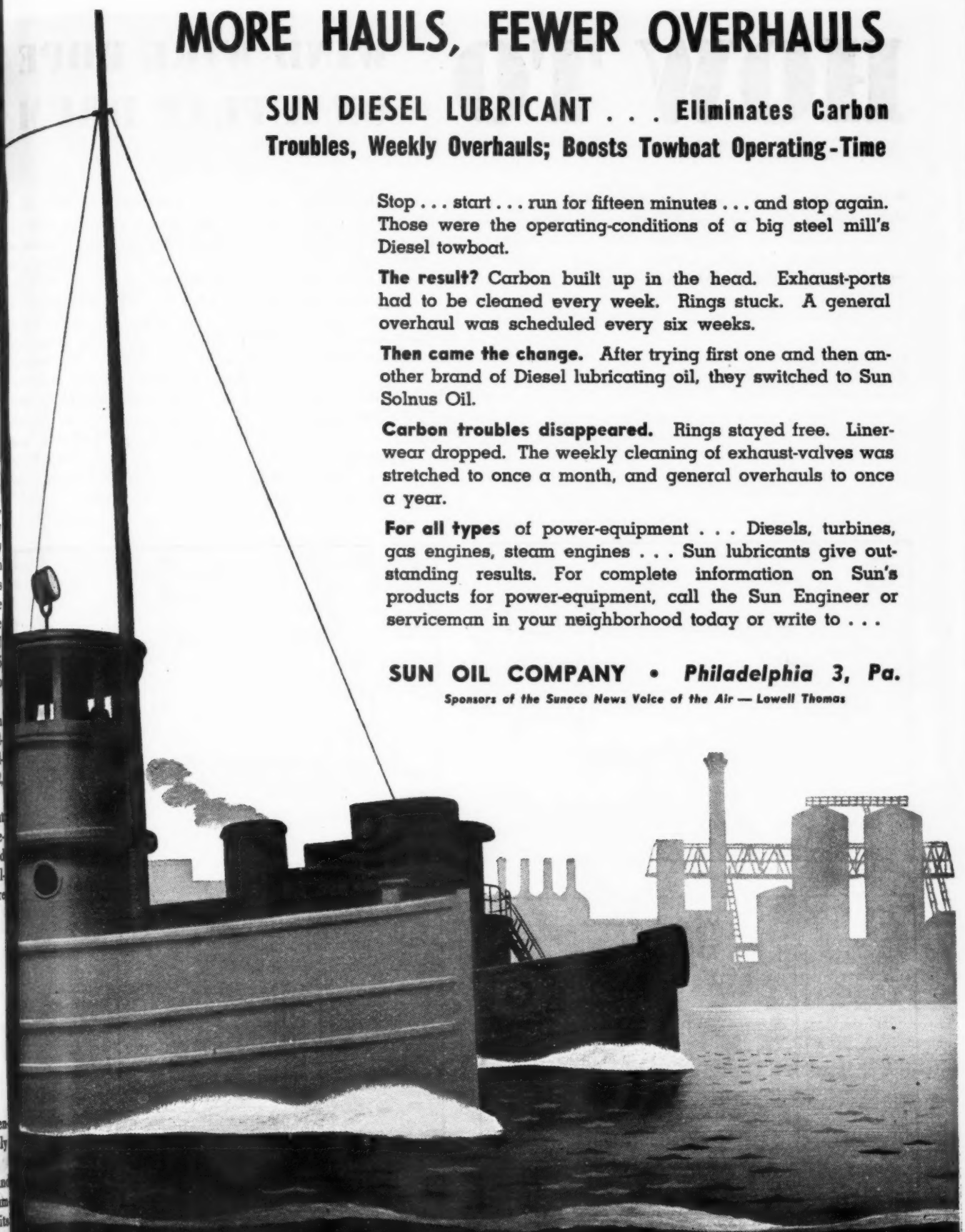

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HOW TO WIND WIRE ROPE ON A FLAT DRUM

▶ BEFORE DESCRIBING how to determine the correct direction of rope lay when placing a single-layer winding on a flat or smooth-faced drum let us define the word *lay* in reference to wire rope. It means the twist or helical form of the wires and strands characteristic of wire rope.

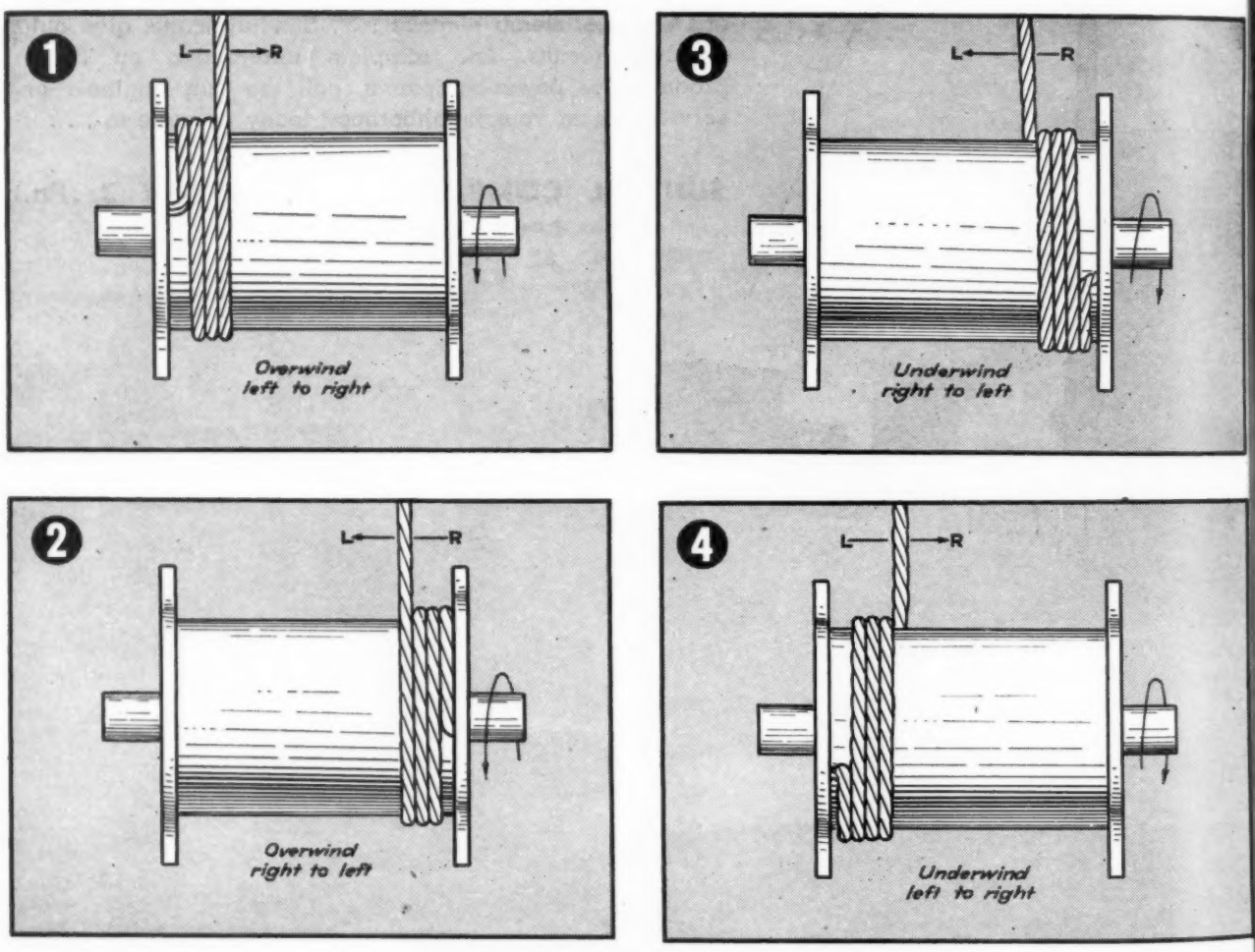
Strand lay refers to the twist of individual wires composing a strand and *rope lay* refers to the twist of the strands around the core. In a *right-lay* rope the strands lie the same as the threads on a right-hand screw. Strands in a *left-lay* rope lie in the opposite direction.

Regular lay applies to rope of either direction of lay in which the individual strand wires lie in a direction opposite to that of the strands. Rope can be either *right-regular lay* or *left-regular lay*.

A *lang-lay* rope is one in which the strand wires lie in the same direction as the strands. Rope can be either *right-lang lay* or *left-lang lay*. In *reverse-lay*, rope wires in alternate strands lie *right* and *left*.

Ordinarily when the kind and direction of lay is not specified *right-regular lay* rope is supplied.

Important advantage of applying rope with correct lay is that when load is slacked off, the coils hug together on the drum and maintain an even layer. If rope with improper lay is used the coils spread apart at each removal of load. When lifting is resumed the rope may crisscross and overlap on the drum, which crushes and flattens the rope. Although the procedure also shows how to attach left-lay rope, most wire rope made today is of right-lay construction. The drum anchorage on new and existing hoists and cranes should be positioned to take right-lay rope because left-lay is not always available from stock. The following method applies to either regular- or lang-lay rope. *Courtesy of Macwhyte Company.*



Observer standing behind drum

1 When rope end fastens to left-hand flange and winds over the top from left to right use a right-lay rope.

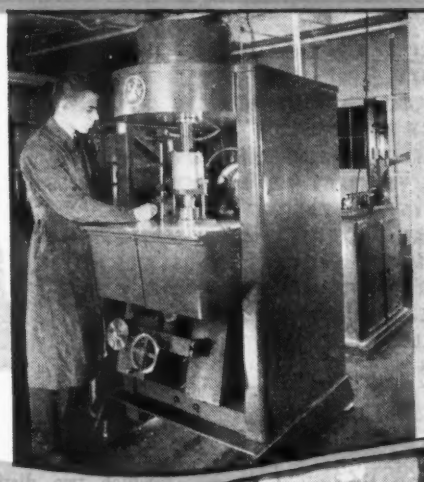
2 Use left-lay rope when rope end fastens to right-hand flange and winds over the top from right to left.

3 On an under-wind drum use right-lay rope when it fastens to right-hand flange and winds right to left.

4 For left-to-right winding with rope fastened to left-hand flange of an underwind drum, use left-lay rope.

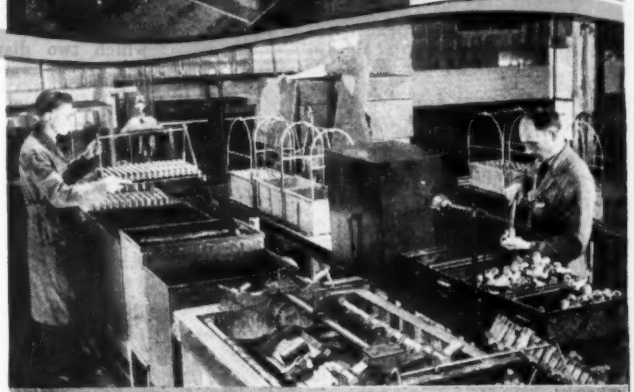
HOW EVALIZING* CUTS VALVE WEAR, GALLING AND FREEZING

PROBLEM: In practically all steel valves there are some steel parts which must turn or slide freely in contact with other steel parts. But in many services, frequent operation, wide temperature and pressure variations and other factors result in wear and galling or binding between the parts. Operation of the valve becomes difficult.



In special machines, built to Edward designs, Edward engineers have tested thousands of metal specimens for wear and galling or seizing characteristics. Electric furnaces make possible elevated temperature tests when desired. The general problem of abrasion has been under study in the Edward laboratories on such equipment for decades.

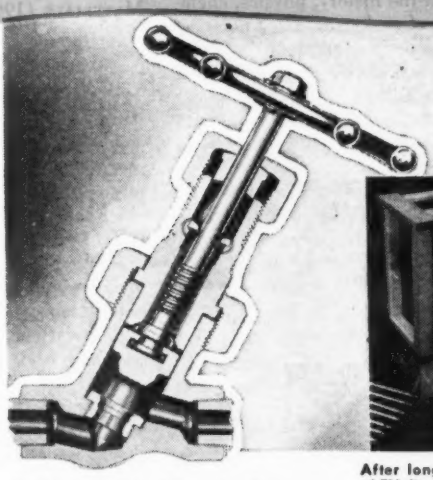
SOLUTION: One Edward answer to abrasion is EValizing,* an exclusively Edward process for coating steel valve parts with a bearing material which reduces friction between moving steel parts by about 25 per cent. It is applied electrolytically to such parts as the internal stem threads of all inside screw forged steel valve bonnets, junk rings, packing nuts, and, in the case of large high temperature, high pressure valves, the nuts used in body-bonnet bolting.



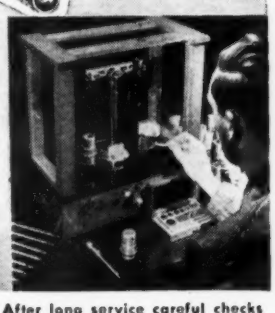
Section of the Edward EValizing department. Special fixtures permit plating of inside screw threads.

RESULT: Edward makes wide use of EValizing and the dividends are in much longer valve life and easier valve operation. For instance, long time tests show that a stainless steel stem can be rotated nearly 1000 per cent more in an EValized bonnet than an ordinary unprocessed steel bonnet. EValizing is a standard feature for many Edward valve parts, and is especially important on such valves as Fig. 2698 forged steel globe valve, right. Built in ¼ in. to 2 in. sizes, screwed or welding ends, and with a companion angle design, this low-cost, all-purpose valve is ideal for a multitude of services.

*Trade-Mark Registered



Widely used Edward Fig. 2698 forged steel stop valves showing areas regularly EValized.



After long service careful checks of EValized and non-EValized bonnets have been made. Loss in weight due to wear in Evalized bonnet approximates ½ that of normal untreated steel bonnet.

EDWARD *Steel* VALVES

THE EDWARD VALVE & MFG. CO., INC.
EAST CHICAGO, INDIANA

Look to Edward for the Best in New Steel Valve Developments

FOR THE ENGINEER'S BOOKSHELF

THE COMING AGE OF ROCKET POWER ..... *By G Edward Pendray*
PROSPERITY ..... *By Murray Shields and Donald B Woodward*
ASTM SPECIFICATIONS FOR STEEL PIPING MATERIALS ..... *Am Society for Testing Materials*
BASICS OF SUPERVISION ..... *By H W Heinrich*
PROBLEMS IN ENGINEERING DRAWING—Series I ..... *By A S Levens and A E Edstrom*
HEATING, VENTILATING, AIR-CONDITIONING GUIDE ..... *Am Society of Heating & Ventilating Engrs*
POWER SYSTEM STABILITY ..... *By Selden B Crary*
INDUSTRIAL ORGANIZATION & MANAGEMENT ..... *By L L Bethel, F S Atwater, G H E Smith, H A Stackman, Jr*
THE CHEMICAL PROCESS INDUSTRIES ..... *By R Norris Shreve*
CHEMISTRY OF COAL UTILIZATION ..... *National Research Council Committee*
MARINE ELECTRICITY (3 VOLUMES) ..... *By J M Dodds*
CONTROLLERS FOR ELECTRIC MOTORS ..... *By Henry Duvall James and Lewis E Markle*
BOOKLETS ..... *Brief Reviews*

Rocket Power

THE COMING AGE OF ROCKET POWER *By G Edward Pendray, asst to the president, Westinghouse Elec Corp; secretary and member of board of directors, American Rocket Society. Published by Harper & Bros, 49 East 33rd St, New York, N. Y. 5¼x8¾ in., 244 pp, cloth.* $3.50.

It is very difficult to write on a scientific subject in a way to please both experts and laymen. Books written to be read by the specialists are Greek to the laymen, while most popular scientific and engineering books distort or conceal the truth, thus alienating readers who know better.

G Edward Pendray avoids both pitfalls. His discussion of the history, physics, chemistry and future of rockets is as stimulating as a novel, a superb example of popular writing; yet there is nothing in it that will offend the sensibilities of the engineer reader who is familiar with chemical and mechanical concepts—quite the contrary, in fact.

In view of the sensational growth of the importance of rockets in this war and their evident great future for both war and peace, the book should be required reading for all mechanical engineers who wish to be well informed on this matter.

Postwar Program

PROSPERITY *By Murray Shields, economist, Irving Trust Co, and Donald B Woodward, research assistant to the president, The Mutual Life Ins Co of N. Y. Published by McGraw-Hill Book Co, 330 W 42nd St, New York, N. Y. 190 pp, 5¾x8¼ in., cloth.* $2.

The United States will emerge from war with human, material and technological resources adequate to provide a nation-wide standard of living unprecedented in world history. The problem of transforming these resources into prosperity and jobs is presented clearly and fully in this book in which two distinguished American economists explain their program for postwar prosperity.

The authors' main point is that without business prosperity we cannot have full employment, and that business prosperity depends primarily on the existence of competitive incentives that spur capital investment so as to provide better tools and equipment for workers, to insure continuously increasing productivity per man-hour of work and to enlarge markets by producing what the consumer wants at low prices.

Steel Piping

ASTM SPECIFICATIONS FOR STEEL PIPING MATERIALS (1944) *Published by the American Society for Testing Materials, 260 S. Broad St, Philadelphia 2, Pa. 344 pp, 6x9 in., paper,* $2.00 *with reduced prices on quantity orders.*

A compilation of standards for those interested in the production and use of steel piping materials. The book includes specifications for pipe, boiler and superheater tubes, still tubes for refinery service, heat exchangers and condenser tubes, castings, forgings and welding fittings and bolts for high temperatures.

Fabrication discussed includes welded, seamless and copper brazing. Materials covered are wrought iron, medium-carbon steel, stainless steel, carbon-moly steel and low-carbon steel. Emergency alternate provisions issued for many of the standards are included.

Industrial Supervision

BASICS OF SUPERVISION (1944) *By H W Heinrich. Published by Alfred M Best Inc, 75 Fulton St, New York 7, N. Y. 180 pp. 5x7½, 17 illustrations, cloth.* $3.

This presentation of the fundamental principles of supervision explains their application to production and safety. Attitude, ability, knowledge and action are the basic tools of industrial supervision, says Mr Heinrich.

Chapters deal with promotion of efficiency, production and safety; how to give orders; how to maintain discipline; reasons and remedies for unsafe practices; how to check worker performance.

Engineering Drawing

PROBLEMS IN ENGINEERING DRAWING—SERIES I *By A S Levens, assoc prof of mechanical engineering; educational supervisor, ESMWT, Univ of Calif., and A E Edstrom, lecturer in mechanical engineering; asst educational supervisor, ESMWT, Univ of Calif. Published by McGraw-Hill Book Co, 330 W 42nd St, New York, N. Y. 52 drawing sheets, plus instruction sheets, 11¼x9 in., cloth.* $2.50.

This set of engineering drawing problems has been keyed to the sixth edition of Thomas E French's "Engineering Drawing." The problems have been thoroughly tested in classroom, and cover orthographic projection, isometric drawing, oblique drawing, etc. The book is ring bound, with plates (printed on tracing paper) and other sheets perforated for easy removal.

While primarily for college classrooms, these problems, together with French's "Engineering Drawing," are well suited for home study by power engineers and others.

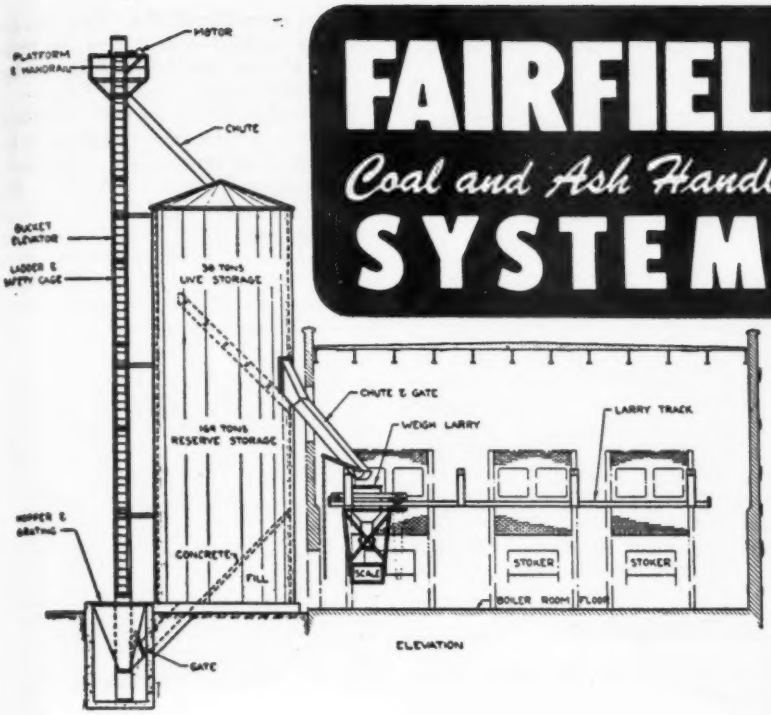
Heating

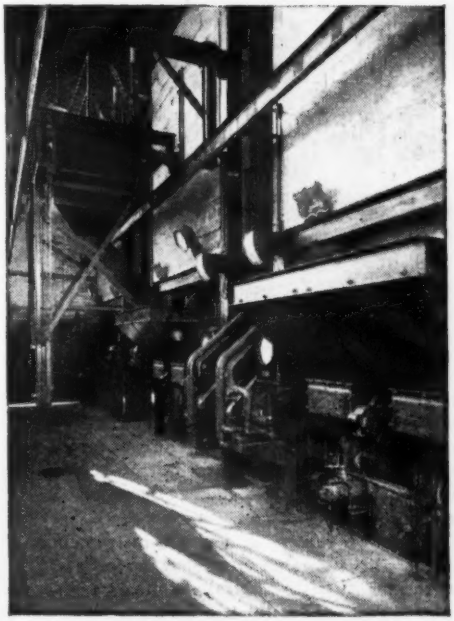
HEATING, VENTILATING, AIR-CONDITIONING GUIDE (1945) *Published by American Society of Heating & Ventilating Engineers, 51 Madison Ave, New York 10, N. Y. Illustrated, tables, cloth, 1216 pp, 6x9 in.,* $5.

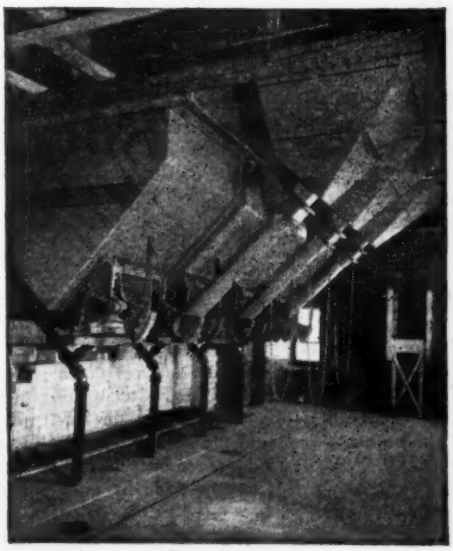
This 23rd edition of the Guide contains 808 pages of technical data, 344 pages of

(*Continued on page* 140)

FAIRFIELD
Coal and Ash Handling
SYSTEMS







• **The Fairfield System of coal and ash handling illustrated is typical of the fully engineered method designed, built and erected by Fairfield to meet the individual conditions of your plant.**

The vitrified tile silo for coal storage resists moisture—the air channels in the tile act as insulation against freezing in cold weather—locating the silo outside the boiler room eliminates dirt inside—the automatic handling of coal from car to storage to stoker or pulverizer makes for low cost.

Illustrated at the top right is a Fairfield Silo with bucket elevator—below this is a hand operated weigh larry for distributing coal to the stokers—at the bottom is shown ash hopper with gates for ash disposal.

If you are considering an addition to your present plant—conversion to coal—or erection of a new plant consult a Fairfield Engineer on coal and ash handling for ultimate economy and continued satisfactory service.

THE FAIRFIELD ENGINEERING CO.

Builders of Coal and Ash Handling Equipment

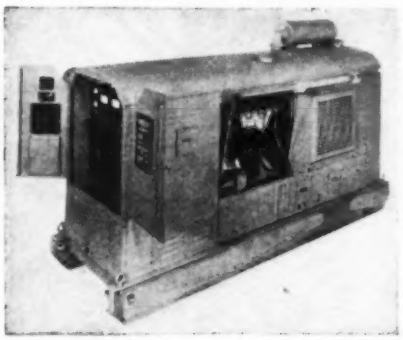
320 CHICAGO AVENUE • • • MARION, OHIO

What's New in Plant Equipment

Diesel Plant

DIESEL GENERATING PLANT, Model DA-30, AAF Type F-2, delivers 37.5 kva at 60 cycles, 240 v, 3 phase, and at 120 and 138 v, single phase. Mounted on a welded I-beam frame the 5000-lb plant is completely housed for operation in any climate. Louvers on housing sides are adjustable for warm or cold weather and unit can operate at outside temperatures from —67 to 130 F.

Special Bardco flexible coupling connects 6-cyl 1800-rpm 61-hp Chrysler industrial engine to single-bearing flange-mounted Bardco alternator with built-in exciter of new design to reduce over-all length. Alternator is forced-draft cooled with Farr air filters and a thermostatic alarm for overheating.



Operation centers in a single instrument panel with a Frahm frequency meter and a vernier throttle control. Voltage regulator is equipped with strip heater for operation in extreme cold. In addition to complete electrical controls, the panel mounts engine instruments and alarm lamps.

Radiator and fan cooling is provided and clean fuel and lubricating oil is assured by Purolator fuel-oil filters and a Skinner lube-oil purifier. The air intake carries an oil-bath filter. It has a 24-v Leece-Neville starting system with provision for plugging-in an external source of starting-battery power. *Bardco Mfg & Sales Co, Los Angeles, Calif.*

Welding Film

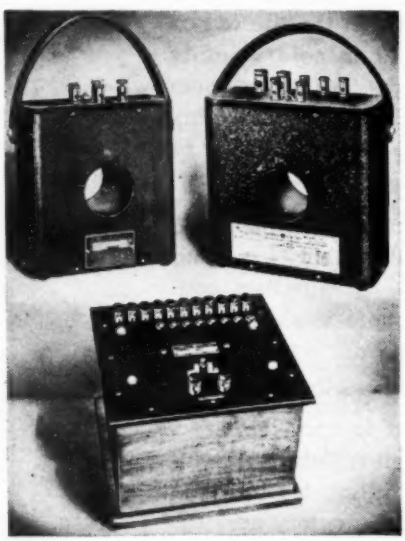
NON-SPATTER FILM minimizes adherence of welding spatter to metal and reduces cleaning time. Welding can proceed after application, whether film is still wet or dry. Priming coats of paint may be applied over film. If it is desired to remove the film before painting, this can be done by washing with water.

One application of film is effective for multiple-pass welding. If film is sprayed or painted on parts prior to being normalized, the oxide film and ordinary scale may be removed more easily after heat treating.

Material will freeze, but freezing has no effect on its properties when thawed out. Film is supplied in concentrated form in 5-gal cans. By diluting concentrated material with three parts of water, 20 gal of film fluid is obtained. Apply film with brush or air gun to areas adjacent to joint to be welded and to welding jigs that may be subjected to spatter. After welding, remove spatter by wiping or brushing. *Lincoln Electric Co, Cleveland, Ohio.*

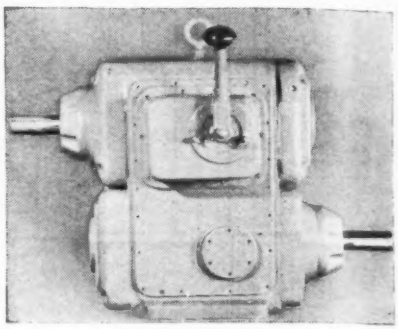
Current Transformers

PORTABLE CURRENT TRANSFORMERS, Types JP-2, -3 and -4, may be obtained as multi-range units. Type JP-2 is also available as a single-range unit. The JP-2 and -3 units meet accuracy requirements of ASA 0.3 accuracy class with burdens B-0.1, -0.2 and -0.5 at 60 cycles. Both units, of through-window construction, are for laboratory-standard work or for testing in field. The JP-2 is not supplied with a primary winding, but there is a hole in the core through which a cable or conductor can be passed. However, there is a tapped secondary winding and the terminals on top of case are all secondary terminals.



JP-3 unit is designed with a combination of wound-primary and through-primary construction. Ratings of 100 amp and below are obtained by a wound-primary with the terminals on top of transformer. By passing a conductor through transformer window once, 1000- and 1200-amp ratings may be obtained. Additional ratings may be gained in both units by passing conductor through window two or more times. JP-2 and -3 units are insulated for use on circuits not exceeding 2500 v. They can, however, be utilized over cables on higher-voltage circuits provided cable is insulated for circuit voltage.

JP-4 transformer is for highest-grade application as a laboratory standard. It is of wound-primary construction with taps in the primary coil for different ratios. Each primary coil, 0.25 to 15 inclusive, is protected by a removable fuse. Secondary terminals have a short-circuiting switch and also a *Thyrite* protector to guard against accidental opening of secondary circuit. *General Electric Co, Schenectady 5, N. Y.*



Variable-Speed Transmission

MODEL HT-1 hydraulic variable-speed transmission, of heavy-duty design, is for continuous-duty performance under varying conditions of load and speed. Infinitely variable speeds are instantly available from zero or full-neutral position to maximum motor speeds forward and reverse. In this drive, unit-torque output remains constant at all speeds. In addition, Model HT-1 offers flexibility of control under all operating conditions.

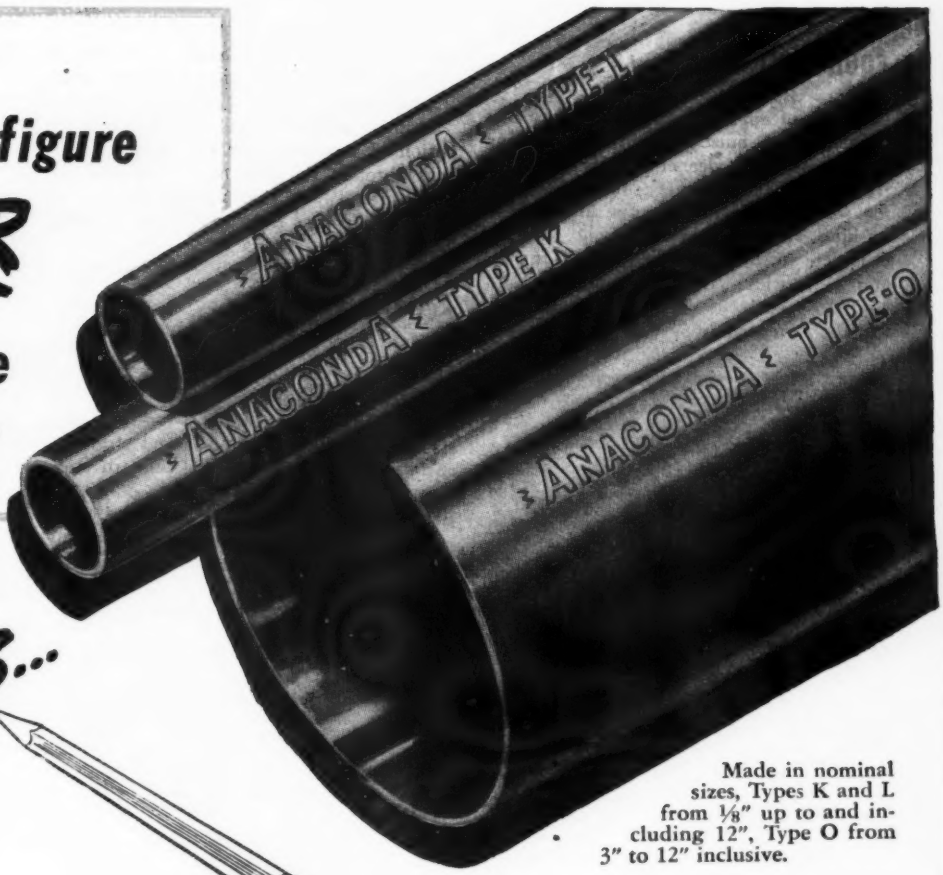
Horsepowers available are 5, 7½, 10, 15 and 20. Maximum speed depends upon speed of electric-drive motors or other prime movers and such speeds are rated at from 900 to 1700 rpm with this unit. In addition to individual hydraulic variable-speed-transmission unit shown, this same transmission can be furnished complete with electric-drive motors for various electric-current specifications and to include base for mounting of hydraulic transmission and electric motor, starters and other controls suited to particular application. *Portman Machine Tool Co, 70 Portman Rd, New Rochelle, N. Y.*

Test Set

PORTABLE SELF-CONTAINED 100,000-v ac test set, with a capacity of 10 kva, is suitable for conducting tests on large high-voltage equipment. Complete equipment consists of an oil-immersed step-up transformer, hand-operated induction regulator for smooth voltage control, double-scale output voltmeter, electric timing clock, overload relay with automatic reset and a 2-pole magnetic contactor. These component parts are inclosed in a steel housing on a 4-wheel truck.

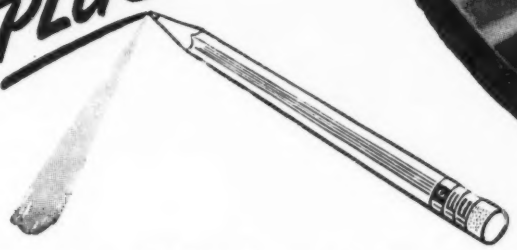
Voltmeter is arranged for a high degree of accuracy throughout complete voltage range up to 100,000 v, at all loads and power factors, permitting precision meas-

How do you figure YOUR Pipeline Costs?



Made in nominal sizes, Types K and L from 1/8" up to and including 12", Type O from 3" to 12" inclusive.

Cost of Tubes PLUS...



WHEN THE TIME comes to install a new pipeline or replace an old one, be sure to figure *all* your costs. For what you pay for materials is only *part* of the total.

That is why Anaconda Copper Tubes frequently prove *less costly* than rustable pipe. Consider these factors:

1. Copper resists corrosion and thus provides long service.

2. The smooth interior of copper tubes, and freedom from built-up deposits due to rust provide reduced resistance to flow.

3. Because of ease of bending, workability and the use of soldered connections, copper tube lines can be installed in less time than pipelines with threaded connections. Here, too, you effect substantial savings.

4. Periodical cleaning of pipelines can be a source of heavy expense. With copper tubes, such expense is usually avoided.

5. A single failure can more than offset the extra cost of a copper tube installation.

Write for publication C-24. It contains useful data on planning and installing pipelines.

NOTE: Restrictions which have controlled our facilities and products for war purposes have been relaxed. We are now permitted, subject to any continuing requirements of the Government, to resume manufacture for many civilian uses.

4573

THE AMERICAN BRASS COMPANY
General Offices: Waterbury 88, Connecticut
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AMERICAN VIBRATION ELIMINATORS

American Vibration Eliminators exclude vibration and compensate for thermal expansion in pipe systems.

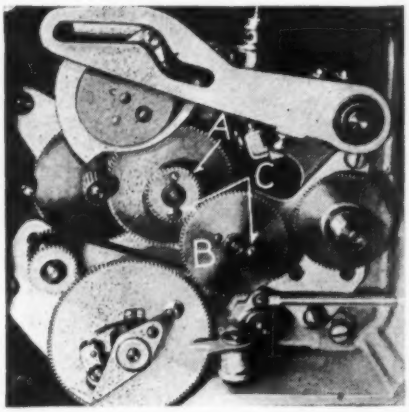
Pressure-tight, safe for conveying costly gases or liquids, such as refrigerants, American Vibration Eliminators are easily installed. For catalogue, write American Metal Hose Branch, Waterbury 88, Connecticut.

Keep Faith With Your Fighters and Yourself! Buy War Bonds for Keeps

ANACONDA *Anaconda Copper Tubes*

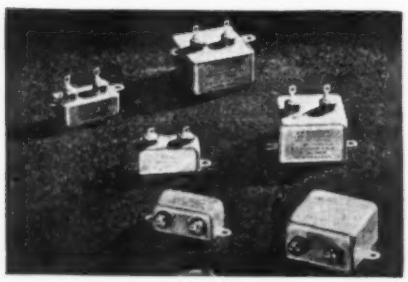
EQUIPMENT *Continued*

urements of applied voltage. A safety foot switch, which must be held down during the test, instantly deenergizes the set when it is released. Another safety device is the screen guard between the high-voltage bushing and operator's working position. Complete set is about 6 ft high, 5¾ ft long and 2½ ft wide. It may be plugged into any 230-v 60-cycle outlet. *General Electric Co, Schenectady 5, N. Y.*



Electronic Recorders

INCREASED INDUSTRIAL USE of electronic recorders has been made possible by stepping up chart speeds of *Electronik Pyro-Potentiometers.* The standard speed electronic recorders, single or multiple point models, incorporate gear changes for speeds of 5, 10, 15 and 20 in. an hr. Fast-speed electronic models, single or multiple point, have internally mounted gears for speeds of 10, 20, 30 and 40 in. an hr. As shown above, gears are changed by removing screw *C* from gears *A* and *B* and by lifting gears from assembly. The new speed gears are then installed and screw *C* is replaced. *Brown Instrument Co, Philadelphia, Pa.*



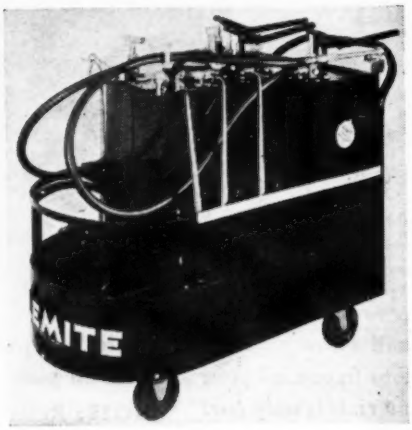
Paper-Dielectric Capacitors

CASE-STYLES CP-50, -51 and -52, characteristic-F, fixed paper-dielectric capacitors are built to the proposed joint Army-Navy Specification JAN-C-25. All three are available in single-section (two bushings, case isolated), dual-section (two bushings, case grounded) and three-section designs (three bushings, case grounded). Cases are of drawn construction, hermetically sealed, with two mounting lugs included as an integral part. With a capacitance tolerance of ±10% for single-section units, or +20 −10% for 2- or 3-section units, sizes range from 0.05 to 2.0 microfarads in ratings of 600 or 1000 v. They range in weight from 2.3 to 5.8 oz.

Primary difference in construction is location of bushings; the CP-50 have bushings through the top, the CP-51 through the side and the CP-52 through the bottom of case. *General Electric Co, Schenectady 5, N. Y.*

Portable Boilers

PARTICULARLY SUITABLE for stoker firing, redesigned portable 2-pass firebox boilers are adaptable to any fuel. Boilers have new self-cleaning crown sheets. Mud-ring construction has been simplified and strengthened. They are available in standard sizes having coal hand-fired ratings of 25 to 250 hp and mechanically fired ratings of 30 to 304 hp, for pressures of 100, 125 and 150 psi. *Titusville Iron Works Co, Titusville, Pa.*



Lubrication Unit

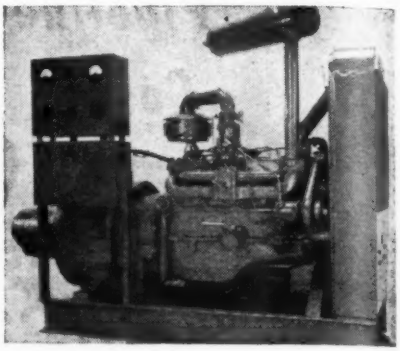
LUBRIKART PROVIDES a complete, compact, portable lubrication dept for plants, with ability to transport and dispense a variety of lubricants. New unit, on 5-in. ballbearing casters, is 21 in. wide, 31 in. long and 37½ in. high. Pushed like a perambulator, it is intended for one-man operation and is able to travel between rows of machines or where space is limited.

New *Lubrikart* comes in two models. The basic model carries two 7-gal tanks equipped with low-pressure pumps with 5½-ft hose and nondrip nozzles for filling oil reservoirs on machines or hydraulic systems and for filling gear housings; one 7-gal tank with high-pressure pump for loading handguns; two 1¾ gal tanks with oil-transfer pumps for filling oil cans; six spout oil cans; and four lever handguns. There is also space for waste, replacement fittings, small tools or other material.

Second model has, in addition to foregoing equipment, a high-pressure hand-operated grease pump that holds 30 lb of lubricant and has a 5½-ft lubricant hose fitted with a hydraulic coupler. This pump develops up to 7000 psi and can be lifted clear of the *Lubrikart* and, if desired, carried to point of use. All pumps, loaders and transfers are manually operated. *Alemite Div, Stewart-Warner Corp, 1826 Diversey Parkway, Chicago 6, Ill.*

Safety Valve

LIMIT-FLOW SAFETY VALVE is installed immediately ahead of upstream end of supply hose and no adjustments are necessary. Standard Model 1000 closes when air flow exceeds 100 cfm of free air with the supply at 85 psi. It delivers this flow through a ¾-in. hose up to 100 ft in length. Models are available for other pressures and capacities. *Associated Valve & Engrg Co, 510 N Dearborn St, Chicago 10, Ill.*



Revolving Field Generator

MODEL 52MPK6, 15,000 watts, 120/208-v ac 60-cycle 3-phase 4-wire 1200-rpm revolving-field *Katolight* generator is powered by Model T-118 Chrysler 6-cylinder 4-cycle watercooled engine. *Katolight* plants provide same kind of current as the highlines, which enables one to operate standard ac appliances, lights, portable electric tools, etc. It is ideal for continuous duty or standby service in power-line failure. Generator is also available for dc operation or special voltages. Unit can be furnished with weatherproof housing. *Kato Engrg Co, Mankato, Minn.*

Measuring Instruments

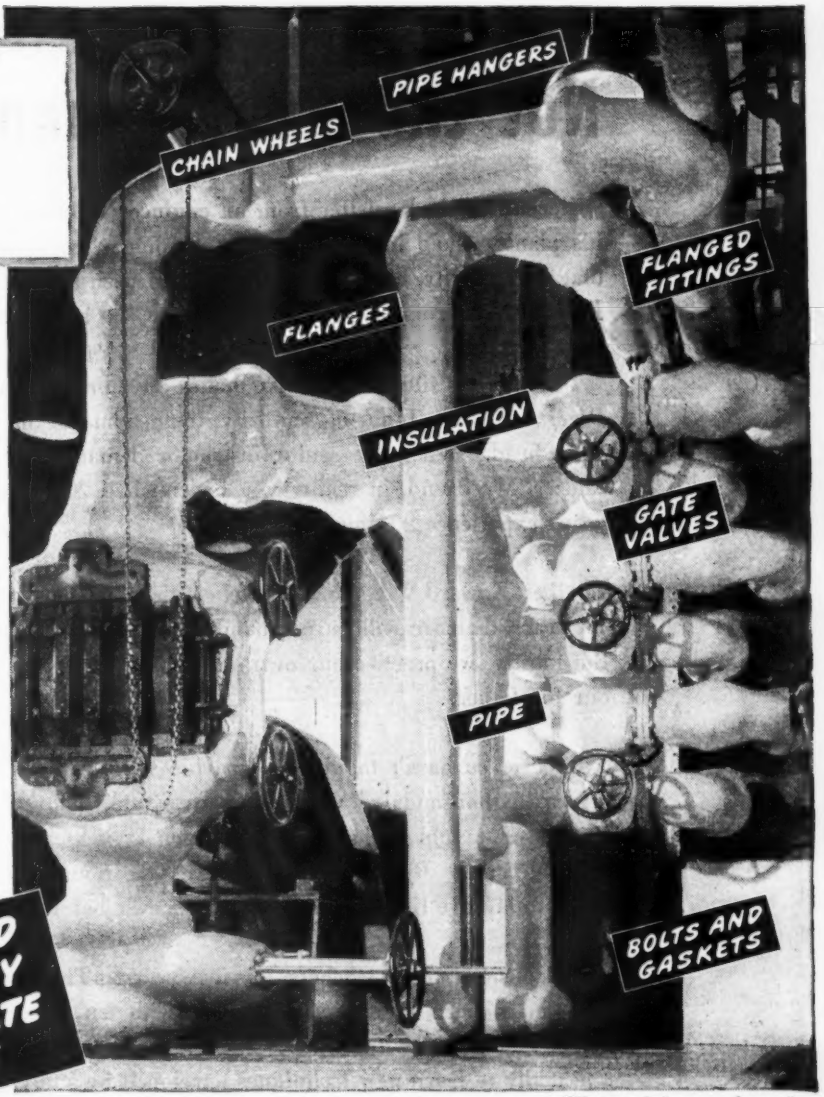
WESTON AC ELECTRICAL measuring instruments can now be furnished with special forms of compensation to maintain their accuracy over the broad frequency range of from 25 to 3000 cycles. It is said that these instruments will prove highly advantageous in those applications using power frequencies above 60 cycles, with smaller associated transformers, higher-speed motors and simpler rectifier filter systems. These frequency compensated instruments are fur-

(*Continued on page* 154)

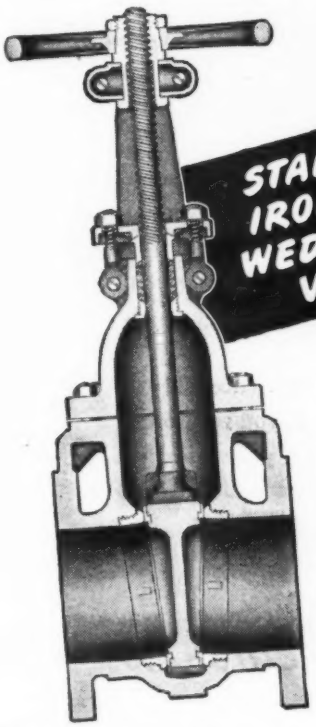
How the Complete CRANE Line Simplifies Piping Replacement Work

ONE SOURCE OF SUPPLY
ONE RESPONSIBILITY
ONE STANDARD OF QUALITY

The unusual completeness of the Crane line is of distinct advantage in "converting" piping systems. See the service recommendations below for Standard Iron Body Gate Valves. Here's a typical Crane solution to many deferred valve replacements. Your Crane Branch or Wholesaler supplies all your piping requirements from the world's greatest selection in brass, iron, and steel equipment. One standard of quality in all materials and one responsibility for them help insure the best installations. Crane Co.'s 90-year manufacturing experience insures long-lasting dependability.



Water piping to air coolers



SERVICE RECOMMENDATIONS: **Crane Standard Iron Body Wedge Gate Valves** are suited for many services in factories and power plants, at all working pressures up to 125 pounds steam. Brass trimmed valves are recommended for steam, water or oil lines; all-iron valves for oil, gas or fluids that corrode brass but not iron. Made in O.S.&Y. and Non-Rising Stem patterns. See page 101 of your Crane Catalog.

Working Pressures

Size of Valve	Screwed or Flanged End Valves		Hub End Valves
	Saturated Steam	Cold Water, Oil or Gas, Non-Shock	Cold Water or Gas Non-Shock
2 to 12 in.	125 pounds	200 pounds	200 pounds
14 and 16 in.	125 pounds	150 pounds	150 pounds
18 to 24 in.	*	150 pounds	150 pounds

*For steam lines larger than 16-in., Crane 150-Pound Cast Steel Gate Valves are recommended. (For sizes under 2-in., use Crane Clamp Gate Valves.)

CRANE CO., General Offices: 836 S. Michigan Ave., Chicago 5, Ill. • *Branches and Wholesalers Serving All Industrial Areas*

CRANE

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VALVES • FITTINGS • PIPE
PLUMBING • HEATING • PUMPS

Not the Best Teacher . . .

Recently, I had a letter from an engineer who had failed to get the chief's job in his plant—who'd in fact lost it to a younger man. He was bitter about it, feeling that his seniority, his years of service, had been ignored, that his age was against him. Judging only from his letter, I think there was another and better reason.

I suspect his situation was like that of the aging instructor described in *The Reader's Digest* for June. Ignoring seniority, the headmaster had made a younger man department head. When the senior instructor demanded an explanation, the headmaster said: "My friend, in reality you haven't had 20 years' experience—you've had one year's experience 20 times!"

Albert Edward Wiggam, the psychologist, contends that we learn little by experience. We learn that fire will burn a hand placed too close, and a few other simple things. But mostly, we practice our own old mistakes and adopt and practice the mistakes of our forefathers.

Experience hasn't taught us to avoid wars—we hadn't even learned how to lay bricks in thousands of years until Dr Frank Gilbreth, motion-study expert but no bricklayer, taught us how. He saw men laying bricks just as it had been done in Biblical times. By scientific analysis of their movements, he taught them in a few hours to lay five times as many bricks as ever before, and with much less effort!

Wisconsin studied teachers for five years. They found that even teachers don't necessarily learn by experience—those with ten or 20 years of experience were no better than those with two or three years. Only those who went back to college repeatedly to learn new techniques developed by study of the combined experience of all actually improved.

My point is simply this—don't confuse years with ability. Your experience is worth money to someone else *only* if you've learned something by it, only if you've profited by all your own and others' ideas and difficulties, and can apply what you've learned to solve your employer's problems. Experience, uninterpreted and unapplied, is *not* the best teacher.

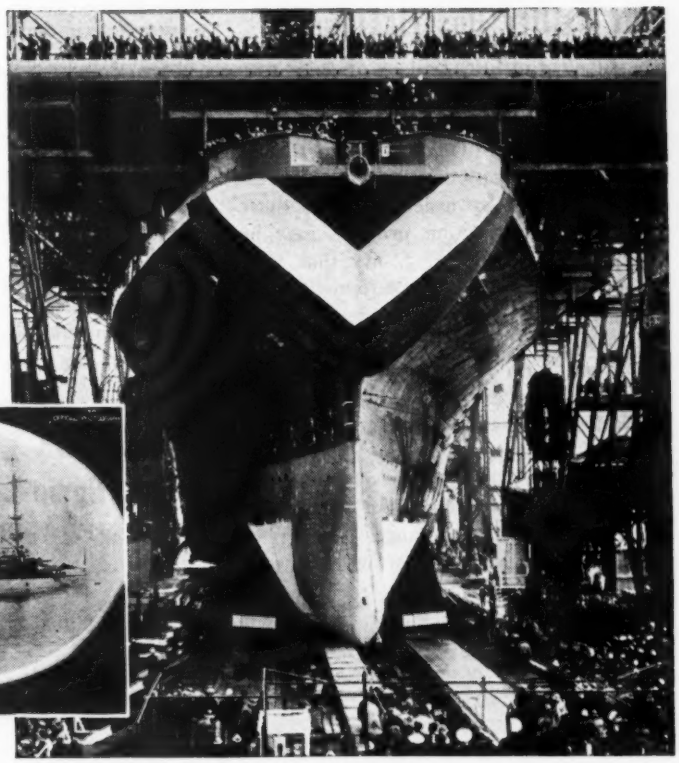
George Edwards

Engineer

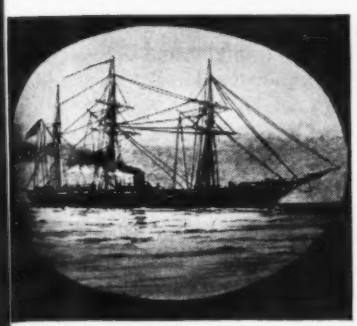
In Ships...and in Packings... you can count on KEARSARGE

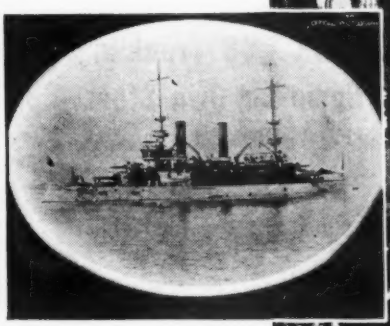
IN the course of naval history, three American warships have borne the name *Kearsarge*. The first had a long and honorable career as a 19th Century sloop-of-war. Then came the battleship Kearsarge, launched in 1900, and still in service as the world's largest seagoing crane ship.

And on May 5th of this year, a new Kearsarge—this one a huge 27,000-ton aircraft carrier of the Essex class—slid down the ways at Brooklyn Navy Yard to become the third fighting ship to carry on the tradition of this grand old name.



Right: Our Navy's newest "fighting lady"—the U.S.S. Kearsarge at her recent launching. Below, left: The first Kearsarge, famous old sloop of Civil War days. Below, right: The battleship Kearsarge—pride of the navy at the turn of the century.





IN packings, too, the name Kearsarge has long stood for exceptional performance. J-M Kearsarge Rod Packing—named in honor of the original U.S.S. Kearsarge—holds an enviable record among packing users for service against high-pressure steam.

Kearsarge is made with a unique folded construction which forms a natural "reservoir" for the preserving lubricant and thus helps keep this packing pliable in service. Additional resiliency is provided by a rubber expansion back in the center block. Around this is a double wrapping of asbestos cloth to assure resistance to wear. Here is one rod and plunger packing that won't *wear* out or *dry* out in a hurry!

Kearsarge Boiler Gaskets—for sealing boiler manholes, handholes and tube plates, and Kearsarge Sheet Packing—the preferred packing for rough flange service, are two of many other Johns-Manville Packings that are cutting repacking costs and helping to reduce shutdown time on vitally needed equipment.

At your Supply House—or write Johns-Manville, 22 East 40th Street, New York 16, N. Y., for further information.

Kearsarge Rod Packing is recommended for service against high pressure steam at temperatures up to 500° F. Furnished in sizes and styles for all normal requirements.

Johns-Manville

PACKINGS & GASKETS

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POWER NEWS

BUSINESS ITEMS AND APPOINTMENTS • WASHINGTON NOTES

FOREIGN FIELDS • MODERNIZATION • FUEL CONSERVATION

Government Plans Removal Of Utility Restrictions

Electric utilities will be on their own by the year's end if present WPB plans are carried out, according to Director Edward Falck of Office of War Utilities. Not only the automatic preference ratings assigned by order U-1, but those assigned construction projects may be wiped out next Jan. 1. By that time some engineering procurement and scheduling of equipment for these projects will be under way.

Some form of spot assistance will doubtless be available to expedite deliveries in case of emergency breakdowns. However, Director Falck urged utilities to make every effort to accomplish their procurement without requesting special assistance.

Falck indicated that order L-94, providing for mandatory interconnections and establishing the machinery for energy rationing, probably will be revoked reasonably soon. He believes that most utility systems will continue to operate their facilities and interchange power with other utilities so as to achieve maximum coordination of power supply. He warned that when the order is revoked this act should not be construed as an indication that interconnection and power pooling is from that time on no longer necessary or desirable. The utilities of the U. S. should make every effort to continue to coordinate power supply on a voluntary basis for the indefinite future. Whether or not L-94 is recalled, it is in the national interest that coordination continue until the end of the war.

After Attack USS Franklin Comes Home on Own Steam

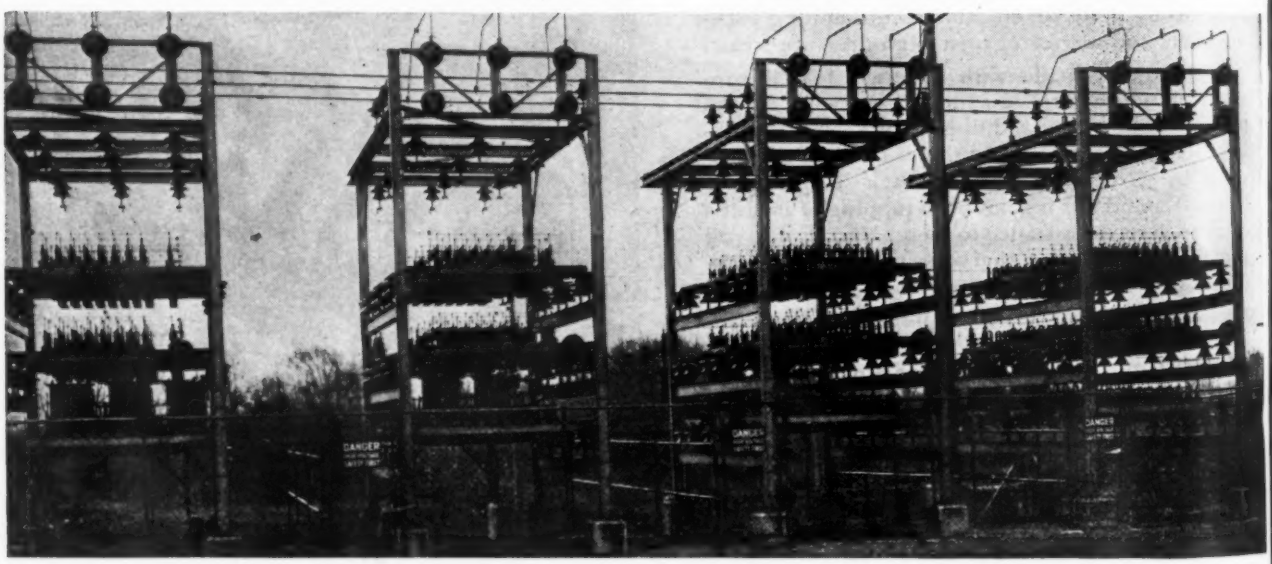
The story of how the aircraft carrier *USS Franklin* sat dead in the water for ten hours, less than 60 miles off the coast of Japan, with four of her boilers damaged and no power to generate steam or electricity, was told by Lt Comdr Thomas J Greene, chief engineer of the vessel. The *Franklin* returned to this country recently after suffering two direct hits last March by a Japanese dive-bomber in an attack that caused crippling damage and high losses and injury to personnel. However, she was able to proceed through the 13,000-mile journey home under her own steam.

Comdr Greene, who has been with the *Franklin* since she was commissioned in Jan. 1944, said: "When the bombs hit, the flight deck was covered with planes ready for the take-off, loaded with gas, bombs and rockets. The bombs set off terrific fires and a series of explosions which completely wrecked the flight and hangar decks, caused extensive damage to the island, through which the boiler stacks pass, and also damaged the uptakes from the boilers to the stacks."

Salt water used for extinguishing fires poured into the furnaces of four of the Babcock & Wilcox boilers through these damaged uptakes and also through

(*Continued on page* 176)

CAPACITOR INSTALLATION HAS HIGHEST VOLTAGE RATING



This bank of Westinghouse capacitors provides 10,000 kvar for power-factor correction. Located at the Franklin Substation of the Ohio Public Service Co, near a center of low-power-factor industrial load, the capacitors are connected direct to a 24,000-v bus. To operate at 24 kv without intermediate transformers, six groups of nine 15-kva 2400-v capacitors, in parallel, are connected in series to make one leg of a phase. Each phase is star connected to form one 2430-kva 3-phase unit on each of the first three structures. On the last structure, at extreme right, capacitors are connected in series in groups of ten, in parallel, to bring nominal capacity of installation to 10,000 kva

here is a thought on the subject of WATER TREATMENT...

(. . . for those who sit in the front office)

"Water treatment is a scientific subject through and through and should be treated as such. Industry can obtain *maximum* benefits from water treatment *only* when the formulae and administration of water-treating chemicals are placed in the hands of a company that looks on water treatment through the eyes of a scientist.

The men in your plant, your operating engineer or master mechanic, who see *first hand* how scale, corrosion, foaming and algae can lower the efficiency and production in your plant—the recommendations of these men should be management's guide in selecting the company entrusted to solve its water treatment problems."

Photo in Nalco Laboratories

Says

Bob Moran

Nalco Representative, New England

THE SYSTEM OF SCIENTIFIC WATER TREATMENT

Nalco

NATIONAL ALUMINATE CORPORATION

6222 West 66th Place • Chicago 38, Illinois

Canadian inquiries should be addressed to Aluminate Chemicals, Ltd., 555 Eastern Ave., Toronto, Ontario

How to plan

PRESSURE-TYPE OIL BURNER CONNECTIONS

Another in the series of the popular Jenkins Piping Layouts appearing monthly in these pages. Watch for them.

Systems using steam to preheat oils, fired under heavy pressure, are widely used in industry today. The accompanying layout, typical of these systems, shows the arrangement of the piping for a multiple burner type boiler.

Flexibility of shut-offs is provided by properly placed valves for use in the event an oil leak or other failure develops. This feature is important when piping oil or other inflammable materials.

To prevent shut-down in an emergency, by-passes are provided around pressure-reducing or relief valves. The by-pass system also assures, at all times, maintenance of required temperature and fluidity of the oil going to the burners. Constant and uniform oil pressure is maintained by an automatic regulating valve.

To insure tight closures and long, trouble-free operation, the Fig. 950 bronze globe valve is recommended as basic for this type of layout. Needle valves should be used on small lines and plug type valves on lines of 1″ or larger, because facility for minute adjustment is necessary for the burner regulator.

Many types and pressure ranges of Jenkins Valves, in addition to those mentioned, could be used for pressure-type oil burner connections, according to the nature of the particular installation. Jenkins recommends consultation with accredited piping engineers and contractors, when adapting these suggestions to your own requirements or planning any major piping installations.

Copies of this layout, No. 3, for reference use will be furnished on request. If you would like, in addition, copies of future "Piping Layouts" as they appear, just fill out and send the coupon below.

Jenkins **PRACTICAL PIPING LAYOUTS**

Illustrating the proved 3-point formula for trouble-free, time-defying hookups

1. **Place valves correctly in the line.**
2. **Use the right type valve for the service.**
3. **Choose Jenkins Valves for lifetime economy.**

3

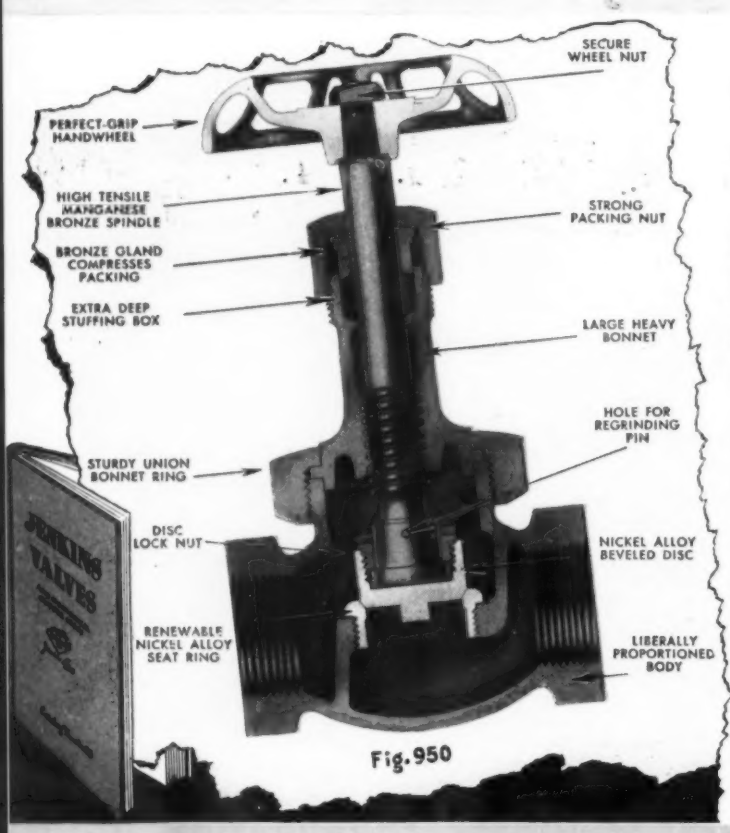


Fig. 950

In this layout, the Fig. 950 Jenkins Regrind-Renew Valve is used extensively. This is a regrinding bevel seat ring and disc pattern, with union bonnet. It is widely used for close control of steam, oil or water—and where service conditions are especially severe. Since the seat ring and disc can be reground without removing the valve from the line, maintenance is simplified. This valve has many Jenkins features of excellence—for example, the design of seating elements permits repeated regrindings before renewal is necessary.

OVER 600 VALVES TO FIT YOUR PLANS

For any piping layout, you will rarely need a valve not listed in the Jenkins Catalog.

Select the valves you need from this one convenient source. You save time, and you get the advantage of Jenkins *better* design, *better* materials, *better* workmanship and specialized valve-engineering experience. You pay no more for Jenkins *lifetime quality* than for other good valves.

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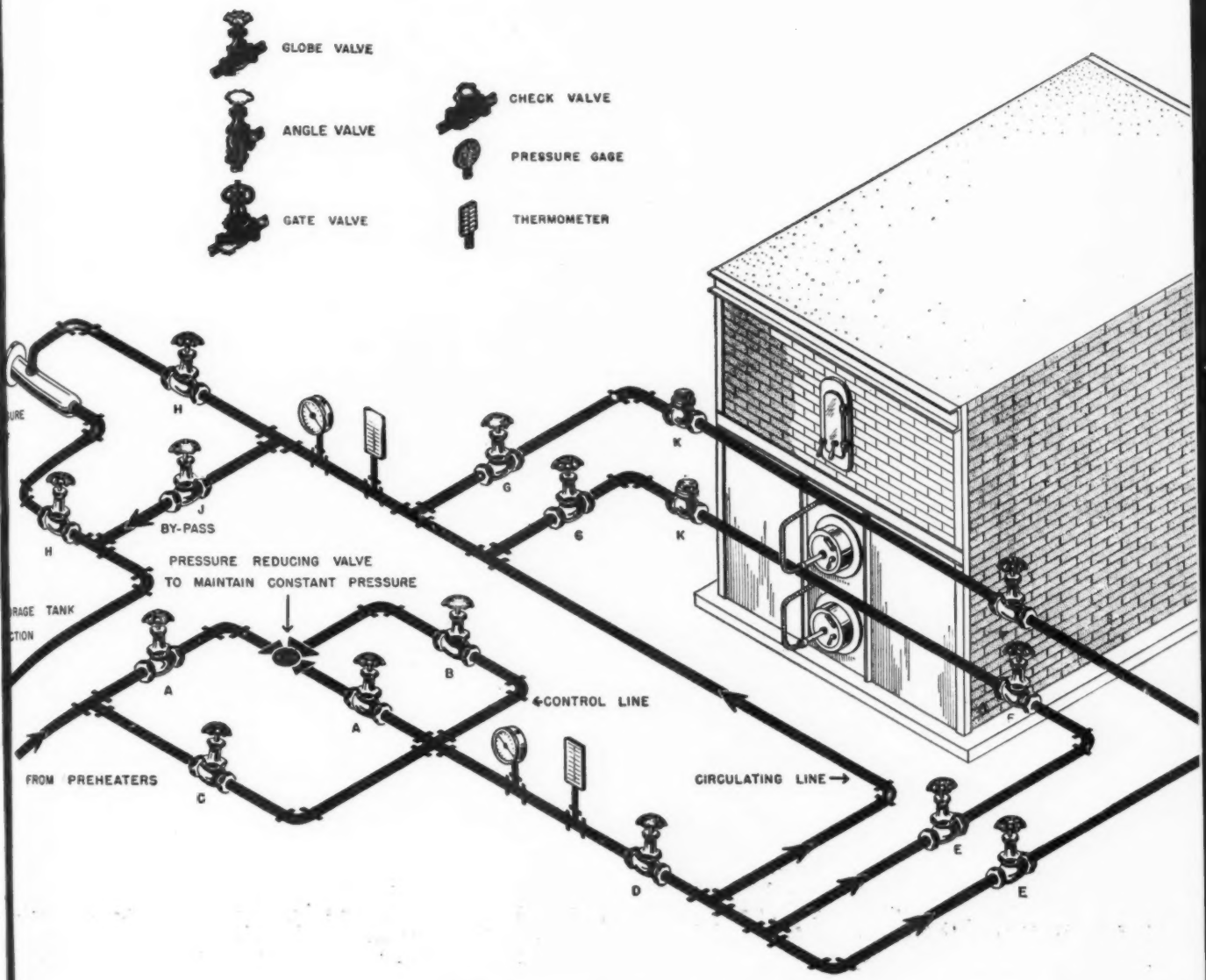
PRESSURE-TYPE OIL BURNER CONNECTIONS



ALVE RECOMMENDATIONS

details – and valves to suit vary-conditions – see Jenkins Catalog.

CODE	QUANTITY	JENKINS VALVES	SERVICE
A	2	FIG. 950 BRONZE GLOBE	PRESSURE REDUCING VALVE SHUT-OFF
B	1	FIG. 950 BRONZE GLOBE	PRESSURE REDUCING VALVE CONTROL LINE SHUT-OFF
C	1	FIG. 950 BRONZE GLOBE	PRESSURE REDUCING VALVE BY-PASS
D	1	FIG. 950 BRONZE GLOBE	CIRCULATING LINE CONTROL
E	2	FIG. 950 BRONZE GLOBE	BURNER SHUT-OFF
F	2	FIG. 741G BRONZE NEEDLE FIG. 950 BRONZE GLOBE	BURNER REGULATOR
G	2	FIG. 950 BRONZE GLOBE	CIRCULATION CONTROL AND SHUT-OFF
H	2	FIG. 950 BRONZE GLOBE	PRESSURE RELIEF VALVE SHUT-OFF
J	1	FIG. 950 BRONZE GLOBE	PRESSURE RELIEF BY-PASS
K	2	FIG. 830 BALL CHECK FIG. 756 REGRINDING LIFT CHECK	BACK-FLOW PREVENTION

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Company

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Number 156

90-Degree Welding Elbows

End-to-Center Dimensions In Inches[a]

Nominal Pipe Size In Inches	Crane Co		Midwest Piping & Supply Co, Inc			Taylor Forge & Pipe Works		Tube Turns, Inc	
	Elbow	Long Tangent On One End[b]	American Standard	Long Tangent	Reducing[c]	Long Radius	Short Radius	Long Radius	Short Radius
	A	B	A	B	C	A	B	A	B
¾	1⅛	–	1⅛	–	–	1⅛	–	1⅛	–
1	1½	–	1½	–	–	1½	1	1½	1[d]
1¼	1⅞	–	1⅞	–	–	1⅞	1¼	1⅞	1¼[d]
1½	2¼	–	2¼	–	–	2¼	1½	2¼	1½
2	3	4¼	3	3½	3	3	2½	3	2
2½	3¾	5	3¾	4⅜	3¾	3¾	3	3¾	2½
3	4½	5¾	4½	5¼	4½	4½	3⅜	4½	3
3½	–	–	5¼	6⅛	5¼	5¼	3¾	5¼	3½
4	6	7½	6	7	6	6	4⅛	6	4
5	7½	9	7½	8¾	7½	7½	4⅞	7½	5
6	9	10¾	9	10½	9	9	5⅝	9	6
8	12	13¾	12	14	12	12	7	12	8
10	15	17	15	17½	15	15	8½	15	10
12	18	20½	18	21	18	18	10	18	12
14 OD	16	–	–	24½	–	21	14	21	14
16 OD	18	–	–	28	–	24	15	24	15
18 OD	20	–	–	31½	–	27	16½	27	16½
20 OD	25	–	–	35	–	30	18	30	20½
24 OD	30	–	–	–	–	36	22	36	22

a — dimensions for both standard and extra strong weights except as noted
b — made in extra strong weight only
c — reducing in all sizes down to half size only
d — made in standard weight only

© POWER

VIOLENT LOAD SWINGS

✓ CHECK THIS "INSIDE" STORY OF SAFETY

MEMO TO: *Operators of High-Duty Steam Generators*
SUBJECT: *Safe Operation Under Emergency Conditions*

Ever have enough of your transmission lines go down to knock your high-pressure topping turbine off the line? Ever have your loads swing violently over a range in which peak load was 18 times minimum -- in which drum pressure surged between limits 700 pounds apart? Then you know what it is to face real emergency conditions.

So does the COPES Flowmatic. The heavy storms of last winter placed unusual demands on many steam generators equipped with this modern two-element feed water control. In every case the Flowmatic held the boiler water level within safe limits -- even under the extreme conditions cited above.

For security reasons, the story of what happened in this plant cannot be published now. But if you'd like to know how closely water level can be stabilized when hell pops loose, ask the COPES man to tell you the inside story of this installation. Write, and we'll have him call.

NORTHERN EQUIPMENT COMPANY-*851 Grove Drive, Erie, Pa.*

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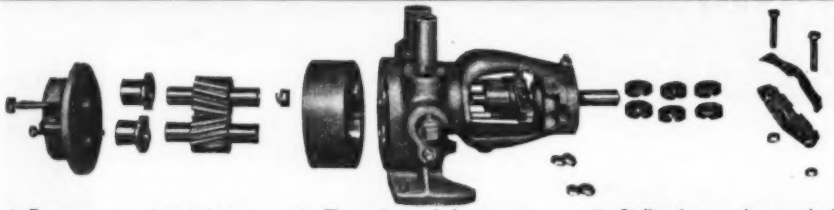
☆ *For* **SAFETY** *and* **ECONOMY** *Specify*

COPES

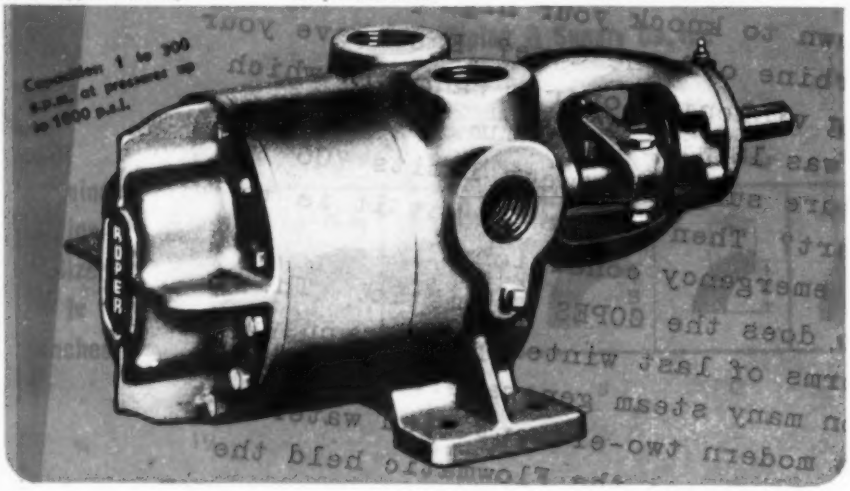
HOW ROPER PUMPS CAN BE SERVICED WITHOUT DISTURBING PIPE CONNECTIONS OR MOUNTING



1 Two cap screws, threaded into jack screw holes, pull face plate. Front flanged bearings and gears slip out easily. Flexible slider coupling is removed thru hole in opposite bearing.

2 The gasket-sealed gear case separates from back plate. Back flanged bearings are easy to get out. The back plate, pipe connections, mounting, and power unit, remain intact.

3 Stuffing box can be repacked quickly with split-ring packing by removing 2-piece cap. Split-gland slides forward on shaft to allow clearance, serves as tamp, and is also removable.



ROPER DESIGN CUTS DOWN-TIME

As illustrated above, Roper pumps are designed for easy accessibility to working parts. It's *not* necessary to disturb piping, power unit, or pump mounting to inspect or replace gears, case, bearings or packing.

When an old unit requires attention, or a destructive foreign element causes trouble, easy accessibility to internal parts cuts down-time . . . helps speed up the service job. And to help avoid costly delays in making repairs, interchangeable replacement parts and packings are available and can be supplied on short notice.

In addition, service and engineering offices are located in principal cities to help you with pumping problems. Investigate the Roper line and facilities today. *Write for full facts.*

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OTHER IMPORTANT ROPER FEATURES

- EFFICIENT OPERATION IN EITHER DIRECTION.
- AXIAL HYDRAULIC BALANCE.
- FLOATING EQUAL SIZE EXTERNAL GEARS.
- OVERSIZE BEARINGS. GEARS SUPPORTED AT BOTH ENDS.
- CONTINUOUS BEARING LUBRICATION FROM PRESSURE TO SUCTION SIDE.
- PACKED BOX OR MECHANICAL SEAL UNITS TO SUIT REQUIREMENTS.
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- 81 YEARS OF EXPERIENCE

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Get full story on Roper time-tested principle and free engineering service. Catalog contains address of Roper pump engineers and service offices in principal cities. Also ask for booklet "How To Solve Pumping Problems."

PUMPS ESPECIALLY ENGINEERED TO FIT YOUR REQUIREMENTS

ROPER *Rotary Pumps*

BUILDERS OF PUMPS FOR MANUFACTURING, MARINE, PETROLEUM, AND PROCESS INDUSTRIES

Canada's Steam Plant

(*Continued from page* 68)

protect the suction well of the pumps.

Space does not permit detailing many other features of the plant that are worthy of consideration. Briefly, it stands as another war contribution of Canadian power engineers. Faced with rigid restrictions on steel and other critical materials and equipment, they designed and built the largest steam plant in Canada in a little over a year. Where possible they substituted reinforced concrete for steel and used second-hand equipment when they could not obtain new. The design is a compromise, of course, but the plant has been in service long enough to prove that it is reliable and economical, and comparable to plants designed and built under more favorable conditions. Best indication of success: In its first year of operation the plant supplied steam and power for the production of 60,000,000 lb of badly needed synthetic rubber and large quantities of chemicals for manufacture of high-octane gasoline. In addition, not only has the plant attained record production, but changes have been made to improve its performance and reliability as equipment has become available.

The plant is owned by the Canadian government and operated through Polymer Corp by the St. Clair Processing Corp, a subsidiary of Imperial Oil, Ltd. Consulting engineers were H G Acres & Co, and construction contractor, Carter-Hall-Aldinger Co.

Pump Q and A

(*Continued from page* 116)

for some industrial processes to pump sludges of various densities. Most of them require pumps of special design, called sludge pumps. Many sludges are too dense to be handled by centrifugal pumps.

Q 17—What is a dry-pit pump?

A—Some vertical pumps are mounted in a dry underground chamber generally called a dry pit. Vertical pumps installed in such chambers or under similar physical conditions are called dry-pit pumps. They operate in air and are accessible at all times for servicing.

Q 18—What is a wet-pit pump?

You Can Have Seats or Plugs in Chapman List 960 Small Gate Valves

Hard or Super-Hard!

Seats and plugs in the rugged Chapman List 960 can be supplied superhardened for extra severe services. This improved small gate valve has quick-acting threads for fast opening and closing—they will not stick or freeze. As no pressure is transmitted to the stem, the valve can be repacked under full pressure.

Chapman List 960 is made in sizes from 1/4" to 2"—carbon steel for pressures to 800 pounds; alloy steel for pressures to 1000 pounds at 750° F. For higher pressures, specify List 990.

The CHAPMAN VALVE MFG. CO.

INDIAN ORCHARD, MASS.

PATENT 1,866,292

A—Vertical pumps designed for suspension in or for mounting in their suction supply like a sump or wet pit are regularly called wet-pit pumps. A sump pump is the commonest type of wet-pit pump.

Q 19—What is a sump pump?

A—In centrifugal-pump terminology sump pump generally applies to vertical wet-pit pumps suspended in a sump or wet well where drainage collects, Fig. 4. Sump pumps are generally automatically controlled by float switches. Small sump pumps to take seepage out of cellars in homes and small buildings are usually called *cellar drainers.*

Q 20—What is a propeller pump?

A—The term was originally applied to pumps using axial-flow impellers, particularly those with diffusion vanes. The name is now applied to diffusion-vane pumps with both axial-flow and high-speed mixed-flow impellers. As most installations of propeller pumps are vertical wet-pit applications, the term generally suggests such an installation. However, such pumps are also installed horizontally and are called horizontal propeller pumps.

Q 21—What is a deepwell turbine pump?

A—It is a vertical-shaft diffuser centrifugal pump of single- or multi-stage design. It is suspended from a driving head by a column pipe that conducts the water to the discharge level and also supports shaft and bearings. This pump is primarily designed for installation in bored wells. See Fig. 8, p 116, July POWER.

Q 22—What is a sinker pump?

A—It is used to dewater mine shafts and similar excavations that have become flooded. This pump is usually supported on a hoist and lowered as the water level falls.

Q 23—What is a close-coupled pump?

A—It is built with a common shaft and bearings for the pump and driver to form a single compact unit, Fig. 3. Some vertical-shaft pump designs have the driver supported by the pump with their shafts connected by a flexible coupling. These designs are sometimes incorrectly called close-coupled pumps.

Q 24—What is an ejector well pump?

A—It combines a centrifugal pump at the well top with an ejector installed below the water level in the well, Fig. 5. Part of the water lifted from the well through the discharge pipe flows down the ejector pipe and through an ejector. This water creates a vacuum above the ejector nozzle, thus allowing water from

Setting a pattern for
STANDARD PROCEDURE

In a constant effort to improve procedures in welding and fabrication Associated has introduced methods which later received wide adaptation. Most recent Associated innovation is a portable, pre-heating, stress-relieving unit (pictured above) designed specifically for field operation. Associated sets the pattern for progress in piping.

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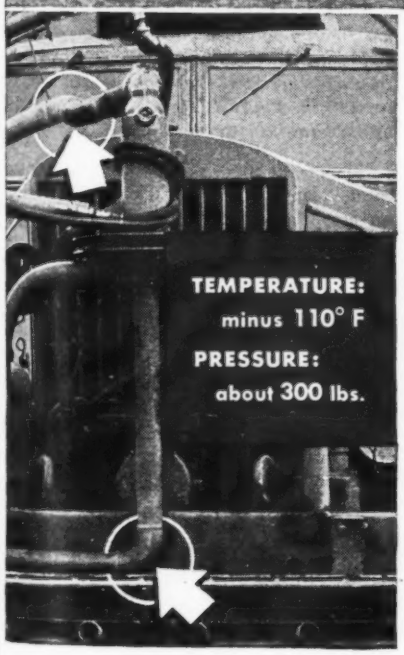
ASSOCIATED *Progressive* **PIPING**

"SNOW" *fights airplane fires*



WHEN this Cardox Airport Fire Truck roars up and releases a mass discharge of *tons* of carbon dioxide "snow" (dry ice) and carbon dioxide vapor at minus 110° F., at pressure of about 300 pounds per square inch — plus hundreds of gallons of fire-blanketing foam—crash fires usually die fast.

Such service calls for the extra strength and reliability of Tube-Turn welding fittings. Their smooth interiors make for maximum efficiency of flow, help in assuring fast, dependable action.

Many equipment manufacturers are discovering what piping engineers have long known—that Tube-Turn welding fittings offer exclusive advantages in any use where piping efficiency is a factor. Tube Turns engineers will be glad to consider your individual problem, without obligation.

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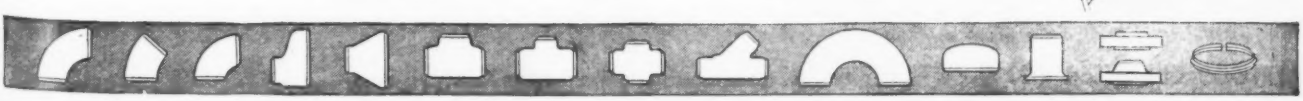

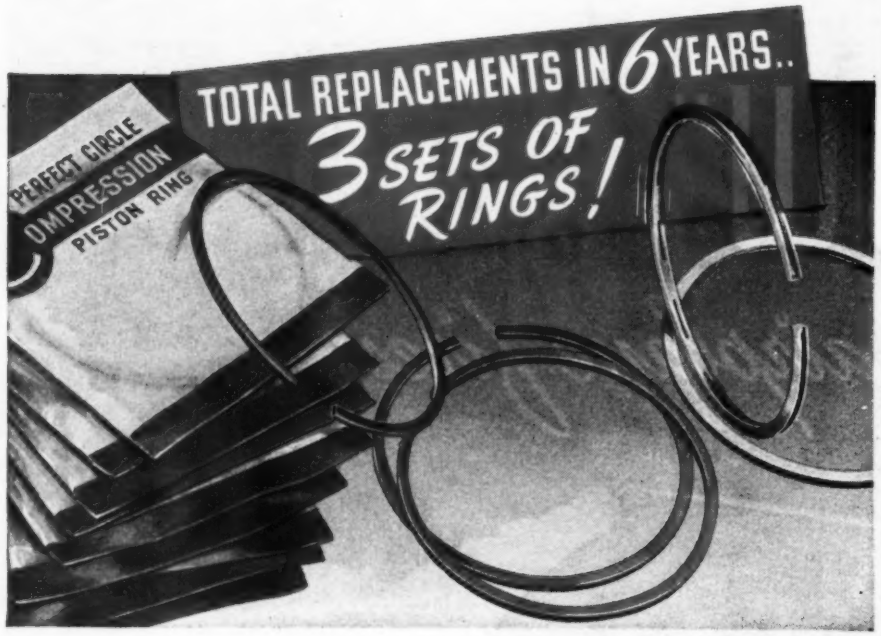

Briggs Lube Oil Clarifier on 150 HP Cummins Diesel Shows Value of Effective Lube Oil Filtration . . .

The record of savings in lube oil and engine maintenance that a Briggs Lube Oil Clarifier and a Briggs Fuel Oil Clarifier produced on this engine is typical of what really effective filtration can do . . . and will do . . . for you.

Compare facts like these with the operating record of your engine or engines . . . Operating hours, 24 hrs. per day . . . Oil change periods used to be every 250 to 300 hours, *now 3 years elapse between oil changes* . . . Piston rings only replacement parts (routine, whether needed or not) since installation of Briggs Clarifiers—6 years ago . . . Fuel pump screens have not been dirty enough to clean since Clarifiers were installed.

Look in your classified telephone directory under "Filters"—find the name of your Briggs Distributor. Get the complete, amazing story of Briggs Clarification from him or write direct for literature. No matter what size or type internal combustion engine you operate—there is a Briggs Clarifier designed to do an effective oil filtration job for it.

D-3-AX Briggs Lube Oil Clarifier which set this performance record. The Cummins Diesel powers a generator that provides light and power and motive power for an air compressor in the shops of Bennett and Landgren Co., Chicago, Illinois.
Briggs

Briggs

BRIGGS CLARIFIER CO. PIONEERS IN MODERN OIL FILTRATION General Offices, Washington 7, D.C.

the well to flow into the suction chamber of the ejector. The mixing of the two streams and the resultant high water velocity through the venturi lifts the water to within reach of the pump. These pumps will lift water about 75 ft. To increase the head against which they will work one design has a second impeller that takes part of the water lifted from the well and discharges it down the ejector pipe.

Engineer's Bookshelf

(*Continued from page* 122)

equipment data and the membership roll. Changes in the new edition include: revised information on cooling-tower practice, a detailed presentation of fan laws and list of fan definitions, extensive changes in the chapter on industrial exhaust systems. A new section concerns electronic heating.

New material has been added to the chapters on terminology, abbreviations and symbols. Conversion equations and constants have been corrected to agree with latest accepted values of the National Bureau of Standards.

Marine Electricity

ELECTRICAL ESSENTIALS IN MARINE SERVICE (*1st edition*—1945) *By J M Dodds, field application engineer, General Electric Co, and instructor of engineering, science and management war training, University of California. Published by McGraw-Hill Book Co, 330 W 42nd St, New York, N. Y.* 419 *pp* 5½x8 *in., illustrations, tables, cloth.* $3.

This is the first volume of a 3-volume library for marine electricians, covering the essential principles of electricity and magnetism and the characteristics of electric circuits. Alternating and direct currents are discussed together and their various uses described and compared.

As this is the introductory volume the author has devoted its first 100 pages to a review of elementary mathematics, physics and mechanics. This is followed by sections on power generation and electric circuits; ac circuits and transformers; application and installation of shipboard cable; marine telephone and communication devices. The treatment is practical and suited to marine and shipyard electricians engaged in installation, testing, repair and maintenance work.

ELECTRICAL POWER SOURCES IN MARINE SERVICE (*1st edition*—1945) *By J M Dodds, field application engineer, General Electric Co, and instructor of engineering, science and management war training, University of California. Published by McGraw-Hill Book Co, 330 W 42nd St, New York, N. Y.* 458 *pp,* 5½x8 *in., illustrations, tables, cloth* $4.

This is the second volume of a 3-volume library for marine electricians, covering

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machines and devices in electric power generation and distribution in shipyards and aboard ships. It is devoted mainly to principles, management and construction of power generation and switching equipment.

The material is divided into seven sections: The electrical machine, its size and rating; construction and characteristics of ac generators; characteristics and windings of dc generators; operation and management of storage batteries; circuit breakers, switches, relays, resistors, regulators, governors and electrical devices; switchboards, meters and instruments; installation. Except in adaptation, marine electric power equipment is practically the same as that used on land. Accordingly, this highly practical book is as well suited to stationary operating engineers and electricians as to those in the marine field.

ELECTRICAL POWER USES IN MARINE SERVICE (*First edition*—1945) *By J M Dodds, field application engineer, General Electric Co, and instructor of engineering, science and management war training, University of California. Pub by McGraw-Hill Book Co, 330 W 42nd St, New York 18, N. Y.* 444 pp 5½x8½*in., illustrated, tables, cloth.* $4.

The third of a 3-volume library for marine electricians is divided into six chapters: ac motors and control; dc motors and control; guide to analysis of control circuits; principles of light sources; electrical propulsion of ships—application and control; maintenance of electrical equipment, trouble detection and correction. Motors and their control have been treated as a unit because characteristics of the motor, particularly the dc types, are largely determined by their control.

The simple and practical treatment given control circuits in the third chapter merits careful study by every electrician. Here standard symbols are explained and then it is shown how these are applied in understanding control diagrams, starting with simple ones and leading to the more complex in easy steps. The chapter on light sources gives a knowledge of lighting fundamentals and their application. Discussed are various new lamps for shore plants and marine use, such as mercury vapor, marine search lights and fluorescent types.

Electric propulsion of ships is divided into dc equipment for the relatively small power plants and ac equipment for the larger ship propulsion plants. More than 25% of the book is devoted to maintenance and trouble shooting, problems close to every electrician's heart. Treatment of all subjects is in language that practical electricians can easily understand. Since there is little difference in the problems of land and marine electrical workers, except that the latter's plants float, this is a valuable contribution to the literature of both.

INDUSTRIAL ORGANIZATION AND MANAGEMENT (1945) *By Lawrence L Bethel, Franklin S Atwater, George H E Smith and Harvey A Stackman, Jr. Pub by McGraw-Hill Book Co., 330 W 42nd St, New York, N. Y.* 798 *pp,* 6x9 *in., illustrated, cloth.* $4.50

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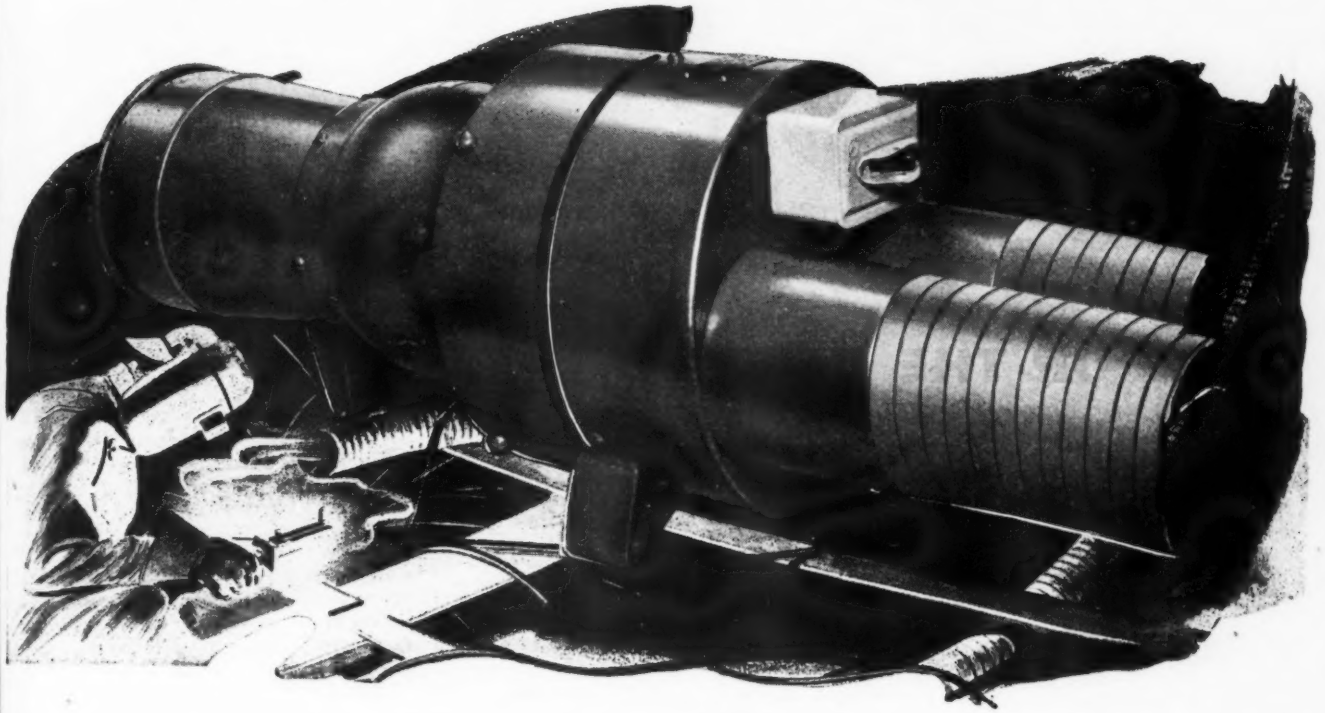

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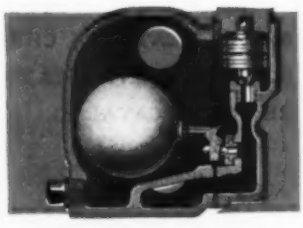

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neer must be familiar with management principles and practices. This book, which covers the entire field of industrial management, should prove helpful to any engineer anxious to review basic principles and acquaint himself with current thinking.

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THE CHEMICAL PROCESS INDUSTRIES (1945) *By R Norris Shreve, professor of chemical engrg, Purdue University. Pub by McGraw-Hill Book Co, 330 West 42nd St, New York, N. Y. 957 pp, 6x9 in., illustrated, semi-flexible binding.* $6.

Although designed as a textbook for students of chemical engineering, this book should prove useful to engineers called on to supply power services to plants in the process industries. It tells how products in each field are manufactured and presents a wealth of flow sheets, integrating chemical processes and unit physical operations. It covers all recent advances in the field.

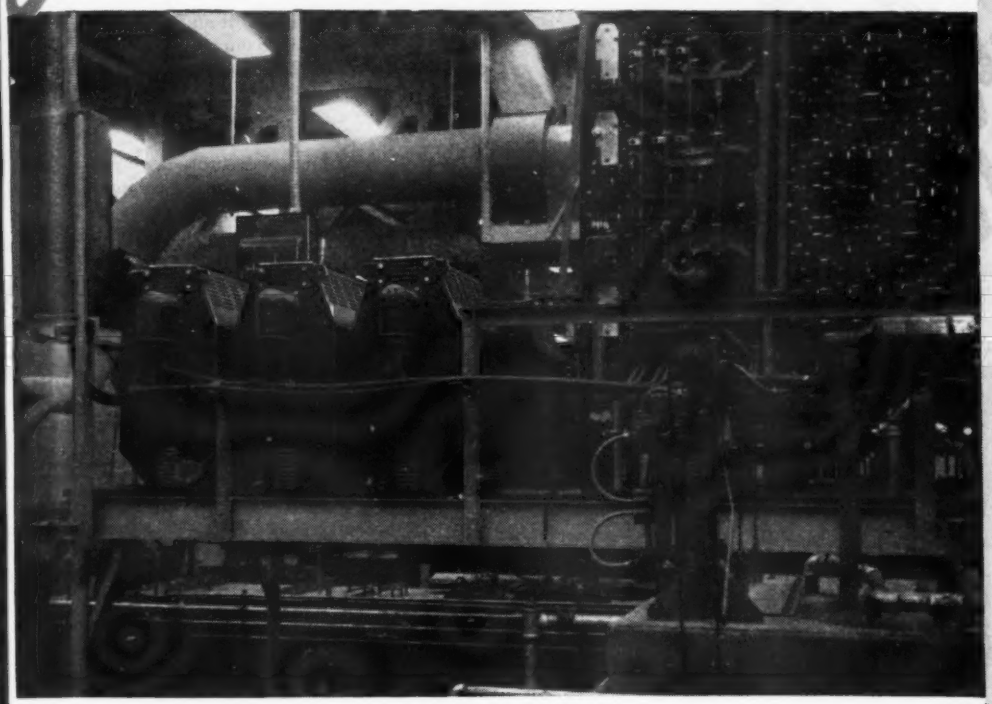
Introductory chapters outline the principles of unit processes and operations, from which even the most complex processes are built, and general fundamentals affecting all types of plants. The remainder of the book takes up, in turn, such processes as water-conditioning and waste-water treatment, destructive distillation of coal, industrial-carbon production, ceramic and cement manufacture, the glass industry, electrolytic and electrothermal processes, manufacture of basic chemicals, production of paints and allied products, sugar and starch, pulp and paper, natural and synthetic rubber production, petroleum refining, and others too numerous to mention.

For each material or industry, the text describes the basic chemistry, the various steps of the process and the equipment used. Flow diagrams are used to good effect to show individual phases of complex processes and to give an over-all view of the sequence of operations.

CHEMISTRY OF COAL UTILIZATION (1945) *Prepared by a staff of 35 contributors under the auspices of a National Research Council Committee, H H Lowry, editor. Pub by John Wiley & Sons Inc, 440 Fourth Ave, New York, N. Y. Vol I 920 pp, Vol II 948 pp; 6x9 in., illustrated, cloth.* $20 *for set of 2 volumes.*

This monumental work constitutes a comprehensive and critical review of the scattered literature on the scientific and practical aspects of coal utilization. In many cases, hitherto unpublished data have been included. Vol I covers the physical and

6 THINGS TO NOTICE in this picture



1. The dry-type transformers are close to the load, yet out of the way.
2. There are no long runs of heavy copper.
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DO YOU REALIZE the many jobs on which you can use small G-E dry-type transformers to advantage? Insulating lighting circuits from power circuits, boosting low line voltage, and supplying the right voltage for the most economical operation of motors, machine tools, and welding apparatus are only a few of their many money-saving applications.

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Easy to install; maintenance negligible—As these transformers are small, compact, and lightweight, and do not require a fireproof vault, they can be installed almost anywhere you wish. The ease of disassembly and reassembly of case parts permits quick inspection and cleaning, when necessary. Operating records show that little or no maintenance is required.

Type D transformers are available in ratings up to and including 100 kva—600 volts and below. For further information, ask for Bulletin GEA-897. *General Electric Company, Schenectady 5, N. Y.*

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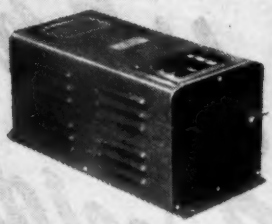

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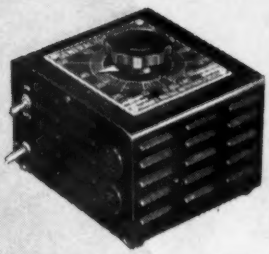

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chemical properties of coal, properties and behavior of ash and other constituents, changes during storage, and coal carbonization in all its phases. Vol II deals with gases produced from coal, tars and other byproducts, combustion in fuel beds and in pulverized form, direct generation of electricity from coal, producers and producer gas, and hydrogenation of coal and tar.

Prepared by experts in the various fields and remarkable for its comprehensive coverage, this work should prove an invaluable reference for the specialist in coal utilization and for the practicing engineer needing full and authoritative information on some particular phase of the subject.

POWER SYSTEM STABILITY—1945. *By Selden B Crary, central-station-engineering divisions, General Electric Co. Published by John Wiley & Sons, 440-4th Ave, New York 16, N. Y.* 291 pp, illustrated, tables, cloth. $4.

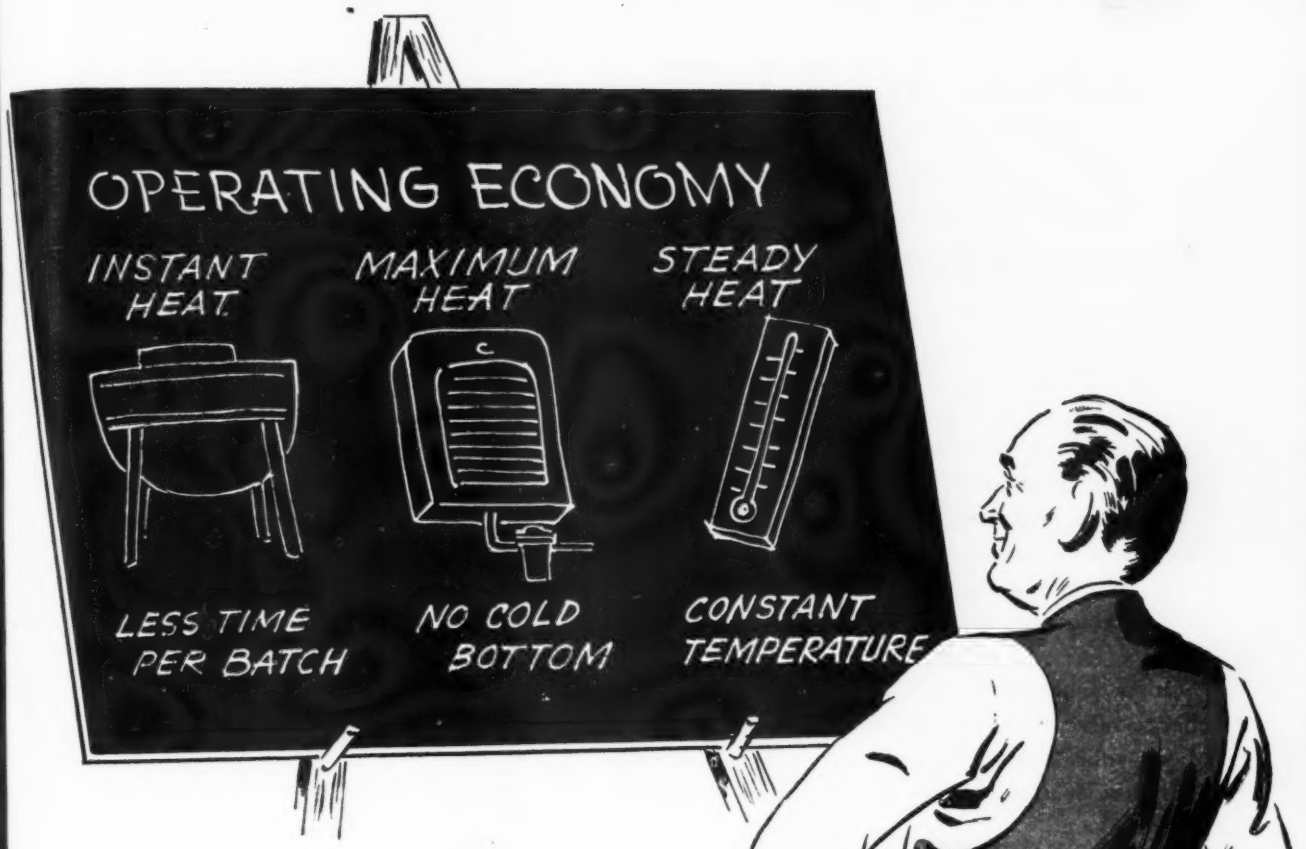
Electric power-system stability is the property that keeps all parts of a system operating as a unit during abnormal as well as normal conditions. As power systems increased in size and were interconnected in networks their stability became of increasing importance. As a result, during the last 25 years engineers and mathematicians associated with power-system-stability studies have produced an extensive literature on different phases of the problem. This book is an outgrowth of the literature. The first of two volumes, it summarizes and integrates some of the fundamental theory and important applications that have played a significant part in our present concept of power-system stability.

Written for engineers who are preparing themselves to be or who are already power-system engineers, the book deals with the theory required for a study of the steady-state-stability characteristics of a power system and discusses the application of this theory to system design. First five chapters are devoted to development of the theory and the last seven to applications. Engineers interested in the design of new power systems, their extension or the rehabilitation of old ones will find valuable assistance here.

CONTROLLERS FOR ELECTRIC MOTORS—1945. *By Henry Duvall James, consulting engineer, and Lewis Edwin Markle, design engineer. Published by McGraw-Hill Book Co, 330 W 42nd St, New York, N. Y.* 329 *pp,* 6x9 *in.,* 337 *illustrations,* 7 *tables, cloth,* $3.50.

Electric-motor control is second only to the motor itself and frequently the control makes it possible for the motor to perform as required by the application. The authors have drawn upon a wealth of experience in the design and application of electric-motor control in describing types and methods of controls in general use. Special control systems for elevators, steel mills, paper machines, etc, are not included because a detailed knowledge of the application requirements is necessary to understand them.

First four chapters are elementary, covering the functions and types of controls



Chalk Talk No. 5

ON POSTWAR STEAM TRAP ECONOMY

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how to make and read control diagrams, and describing construction and operation of magnetic contactors. This gives a background for an understanding of the following 18 chapters, which cover a wide range of control methods and applications to both dc and ac motors. These include methods of acceleration, speed control, mechanical and dynamic braking, regeneration braking, series parallel control, etc. The chapter on electron-tube control covers one of the latest subjects in motor control. Protective devices, an important part of every control, are given extensive treatment as are the National Electrical Code, control installation and maintenance. Treatment of all subjects is practical and readily understood by everyone interested in electric-motor controls and their application.

Booklet Reviews

MANUAL OF INSTRUCTIONS ON PROPER FIRING METHODS IN THE INTEREST OF FUEL COMBUSTION AND CONSERVATION, AIR POLLUTION AND SMOKE ABATEMENT *Pub by Smoke Prevention Assn of America, Inc, 139 N Clark St, Chicago 2, Ill.* 72 pp; *copies may be had on request when accompanied by 25¢ in postage to cover mailing cost.* This manual covers various stokers for industrial and domestic plants and for the home. It gives instructions in fuel selection, proper burning method and fuel conservation. Classified trade directory in manual presents coal distributors and equipment manufacturers.

Following publications may be secured from National Electrical Manufacturers Assn, 155 E 44th St, New York 17, N. Y. Publication No. 45-104 is priced at 25¢ per copy and publication No. 103 at 50¢ a copy.

NEMA STANDARDS FOR ELECTRIC WATER HEATERS Publication No. 45-104 is a compilation of existing NEMA standards for storage electric water heaters. The standards included cover: voltage ratings, pressure ratings for tanks, wattage ratings of elements for single and twin-unit heaters; temperature settings, differentials and adjustment ranges for thermostats; standard-wire-color coding for connections.

TEST SPECIFICATIONS FOR AUTOMATIC ELECTRIC STORAGE WATER HEATERS Publication No. 103 on test specifications establishes a procedure for determination of performance of electric storage water heaters in terms of safety, effectiveness, durability and convenience with respect to minimum requirements.

WORLD TRADE ROUTES *Available from N. Y. Journal of Commerce, 63 Park Row, New York 15, N. Y., at 25¢ per copy.* Pamphlet gives a complete survey of available vessels, number of monthly sailings and ports of call in each of the principal ship routes of the world. It traces the wartime fates of the world's merchant ships and their contemplated peacetime uses.

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Boiler Room Trouble Shooter in Action . . .

When you call the Dearborn Engineer to take the trouble out of boiler water, he "gets down to cases". . . right in your boiler room. He comes to you with the experience and background of a boiler water expert.

First, he makes an analysis of the troublesome feedwater; identifies what is causing your boilers to foam, scale, or corrode; and takes steps to stop these harmful activities.

Meanwhile, wires are hot and mails are busy as he maintains constant contact between your plant and the Dearborn main laboratories. Here, there is a hum of activity as they double-check the data he forwards to them. Here, too, a special treatment is formulated that will neutralize trouble makers and assure boilers of good steaming capacity and extended operation.

Your Dearborn Engineer knows local water characteristics. That's why he can not only assist you in an emergency but establish a routine that minimizes trouble. Call him . . . or write to us direct.

Dearborn Engineer does this for you . . .

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CORAVOL LINES BOILER *Does it for you - -*

QUICKLY *and* EFFECTIVELY

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Cooling and Condenser Water . . . Rapid Scale Removal . . . Coagulation . . . Algae Control

The use of **CORAVOL** saves you costly pipe repairs, replacements, maintenance labor, hours and days of shutdown loss. **CORAVOL** (1) *prevents corrosion* in steam and condensate lines, (2) *cleans out* clogging rust deposits already present. Thus, **CORAVOL** *protects lines;* increases effectiveness of heat transfer surfaces; restores original capacity of lines and the operating efficiency of valves and traps.

CORAVOL is NOT a boiler feed water treatment. It is designed expressly for use in steam systems. Because **CORAVOL** volatilizes and condenses with the steam, it circulates throughout your entire steam system and protects *all* zones from corrosive attack.

For 8 years, **CORAVOL** has proved its value in hundreds of heating and steam power plants in more than 20 different industries.

Mail the coupon TODAY for complete FREE data about the **CORAVOL** process.

MAIL TODAY

WESTERN CHEMICAL COMPANY
715 Washington Street — Kansas City 6, Missouri

Without obligation to me, please send complete data on the CORAVOL Process

NAME _____ TITLE _____

COMPANY _____

ADDRESS _____

CITY AND STATE _____ (3)

able from Supt of Documents, Government Printing Office, Washington 25, D. C. 202 *pp, at* 35¢ *per copy.* Industry Series No. 16 is the first in a series of small-business manuals prepared by the bureau for guidance of those who plan to establish enterprises. Some 19 books are in course of preparation on such subjects as sawmill business, automobile repair shop, building contracting, heating and plumbing, etc. Industry Series No. 16 covers several kinds of shops in metal-working field. It is assumed that the reader is a thoroughly experienced skilled worker. Therefore, the mechanical side of the business is not covered except as it pertains to management.

THE WHY AND HOW OF THE BUDA UNIVERSAL NOZZLE AND INJECTOR TESTER *Prepared by Buda Co, Harvey, Ill.* 32 *pp,* $1. Manual covers minor but important maintenance and adjustment procedures for injectors and nozzles to which the Buda nozzle and injector tester is adaptable. Tabulated list, appearing in the last pages of this manual, gives the data for current or popular models of diesel engines.

Reader's Problems

(*Continued from page* 113)

considerably lowered maintenance expense as the equipment is in bad shape.

In selling the new installation to management, the financial advantages can probably be best illustrated thus:

Assume that the new boiler will operate at an average of one half its maximum capacity (40,000 lb per hr) for 8000 hours, or 320 million lb per year. Generating steam in the new boiler requires 320,000,000 divided by 9.5 or 33,700,000 lb of coal. Generating steam with the old boilers requires 320,000,000 divided by 7.6, or 42,400,000 lb of coal. Difference in consumption, 8,700,000 lb, or 4350 tons at $5.50 per ton will effect a direct reduction in fuel cost of $23,900 per year.

As the new installation should not cost over $160,000, fuel savings alone should pay its cost in less than seven years. Considering this fuel saving, the lowered operation and maintenance cost of a single modern boiler, and the fact that the old equipment will require replacement in the near future, the new boiler is an attractive investment.

Alexandria, Va. C E MILLER

Gov Dwight Griswold, of Nebraska, told the state's Congressional delegation that he opposes a too-powerful federal authority for development of the Missouri River. He believes such control as has been proposed should be in state hands, with federal control limited to technical assistance and support.

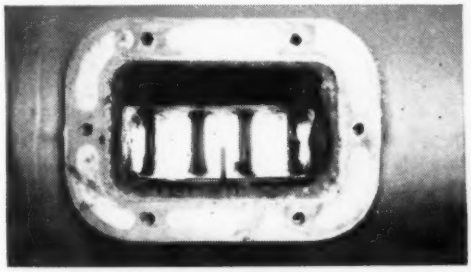
Clean ports pistons and crankcase . . .

show why there was half the wear in one year's operation with Nonpareil HD Diesel Oil

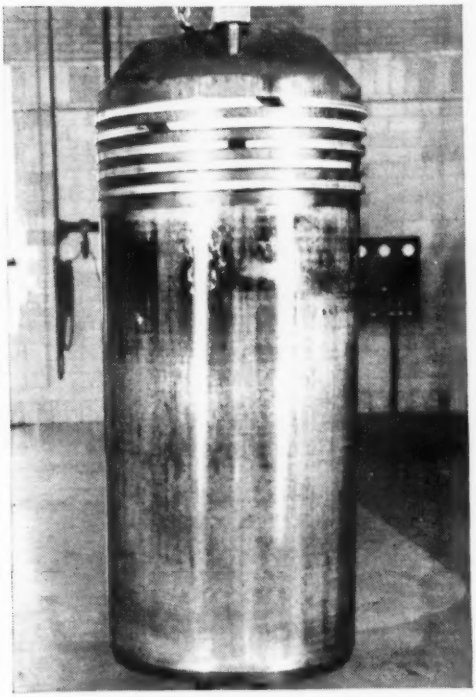
After a new 10-cylinder, Model 33-E-16 F-M Diesel operated 6700 hours during its first year in one of the largest Diesel plants in Illinois, cylinder measurements showed that there was less than half the wear usually expected in such initial wear-in and running of a new engine. The accompanying pictures show the condition of the engine at the time of inspection.

Rings are free, and there is no varnish on the pistons. Exhaust ports are almost unbelievably free from carbon or deposits. The interior surface of the crankcase looks like new.

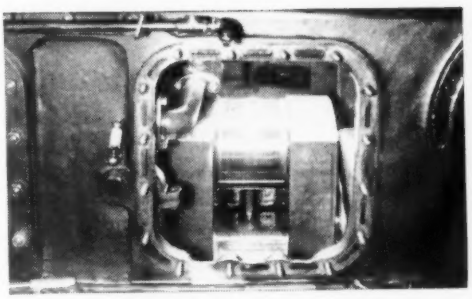
This complete freedom from troublesome deposits—the result of unusual oxidation stability *plus* detergency in Nonpareil HD Diesel Oil—means less wear, maintenance, and down time on *any type* of industrial, marine, or railroad Diesel. Put it to the test on one of your engines. A Standard Oil Lubrication Engineer will be glad to help you. Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois, for the Engineer nearest you.



When this picture was taken, ports had not been cleaned for about 1000 hours of operation.



After 6700 hours, no rings *needed* replacing.



Note absence of deposits in crankcase recesses.

Buy more War Bonds

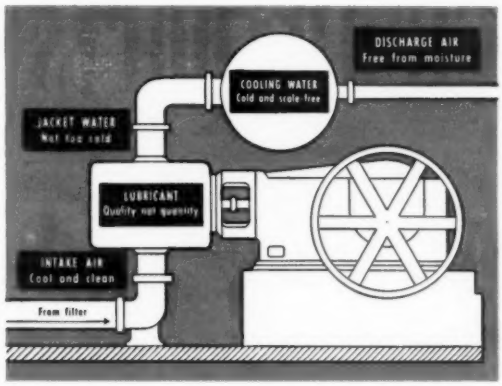
STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

★ LUBRICATION ENGINEERING

LUBRICATION ENGINEERING...LUBRICATION ENGINEERING...LUBRICATION ENGINEERING...

LUBRICATION ENGINEERING...LUBRICATION ENGINEERING...LUBRICATION ENGINEERING...LUBRICATION ENGINEERING...

To help you avoid deposits in compressors



CONDITIONS under which compressors operate, particularly under today's heavy loads, tend to cause excessive deposits.

Improper lubrication is not always responsible for these deposits, but a compressor lubricant with the right qualities can reduce or eliminate many of them. Stanoil is such a lubricant.

The causes of some of the more common compressor operating problems and suggested cures, as well as the advantages of Stanoil, are listed on this page.

A Standard Oil Lubrication Engineer will be glad to help you apply the right grade of Stanoil to overcome excessive deposits and wear on your compressors. Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois, for the Engineer nearest you.

STANOIL

Buy more War Bonds

Causes and Cures

Valve Deposits—Oxygen in the air and heat generated by compression tend to oxidize conventional oils, causing the formation of carbon and asphaltic substances which deposit on valves.

To avoid oil oxidation, keep intake air temperatures as low as possible. Be sure inter-coolers and after-coolers are supplied with an ample supply of cool water, and keep them free from scale and rust. Use Stanoil, from which the unstable hydrocarbons—those affected by heat and oxygen—have been removed, thus eliminating many troublesome deposits at the source.

Dirty Intake Air. The enormous volume of air required by compressors may introduce a large quantity of dirt and dust which contributes both to excessive wear and deposits. Use efficient air screens and keep them clean. Be sure they are not located near a source of dirty air. Use Stanoil which resists the formation of gummy deposits that might collect dirt and dust and add to deposits on valves.

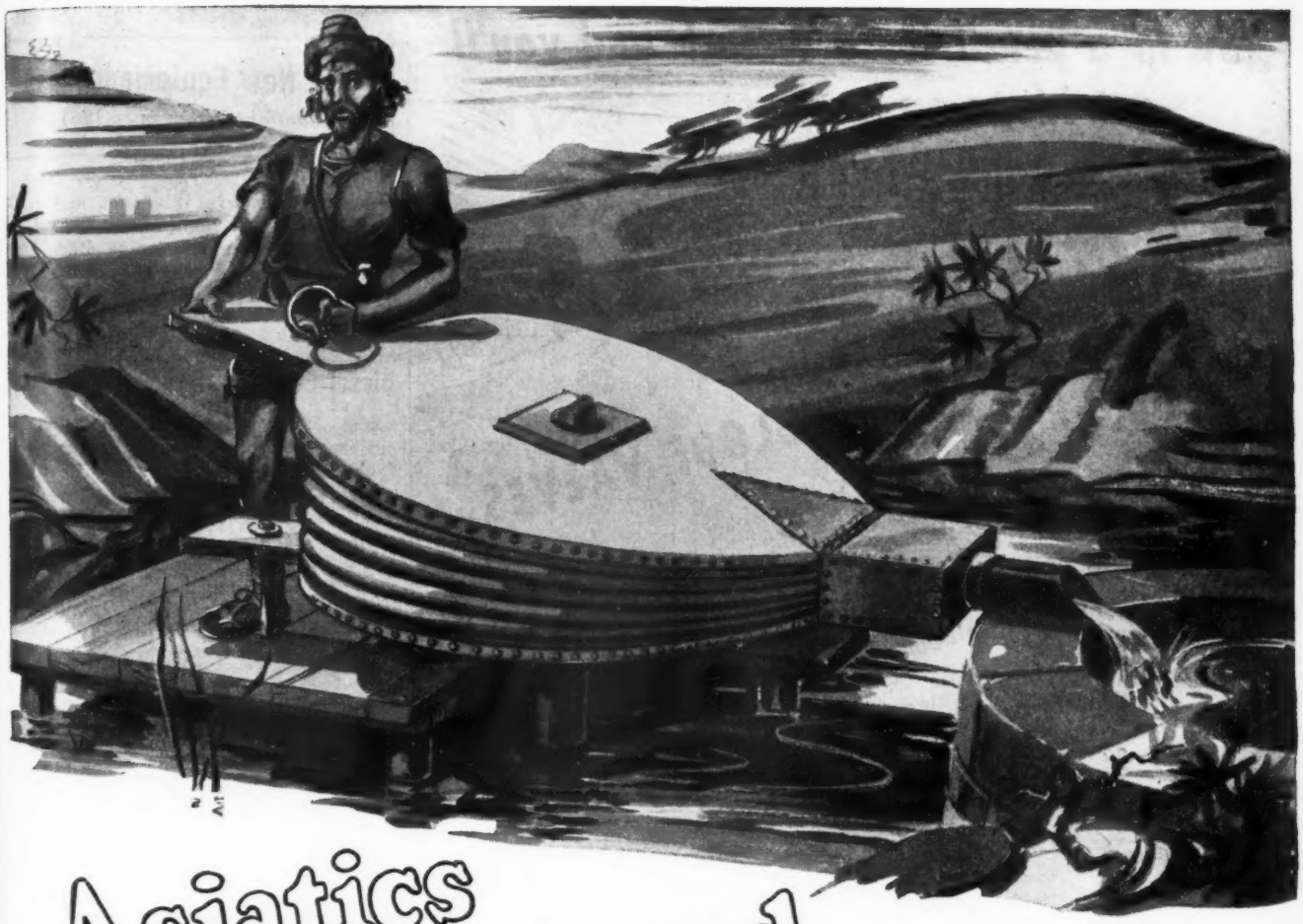
Condensation in Inter-Coolers. Water in the inter-cooler should be cold enough to condense oil and moisture in the compressed air so that they can be removed before entering the high pressure cylinders where they might cause excessive deposits.

Over-Lubrication. Oil is not burned up in compressors as it is in internal combustion engines, nor is it washed away as it is in steam engines. Oil remains in the compressor cylinder, and if it is of the right quality, very little is needed. An excessive amount of oil increases the possibility of deposits in valves, inter-coolers and air lines. Compressors usually require from 1/5 to 1/10 as much oil as steam cylinders of similar size. Because of the high lubricating quality of Stanoil, only a very small amount is needed to secure adequate lubrication.

STANDARD OIL COMPANY (INDIANA)

STANDARD SERVICE

★ LUBRICATION ENGINEERING



Asiatics Acclaimed this "Modern" Water Elevator

IMAGINE yourself living four thousand years ago, pumping water with this new Persian invention. What a wonderful improvement it was over lifting water a jugfull at a time from the stream-bed...to irrigate crops or to carry home.

But the world left Persia and this marvelous labor-saving water elevator far behind. Why?

Because the western world discovered plentiful supplies or iron ore, learned how to make steel, how to fabricate it into pipe, sheets, plates, rods, wire, etc., and how to manufacture an endless variety of products that would amaze and confound those ancient Persian inventors. Pumps, valves, tanks, piping and other parts of modern water supply systems are possible for everybody only because steel manufacturers, such as Youngstown, have developed ways to produce steel and steel products in tremendous quantities, at a cost within reach of everyone.

So when you buy or use a piece of steel pipe, inexpensive and commonplace though it is, you may well realize that without our abundance of excellent steel we in America today might be using the ancient Persian water elevator-and still calling it modern.

QUALITY YOUNGSTOWN SERVICE

YOUNGSTOWN

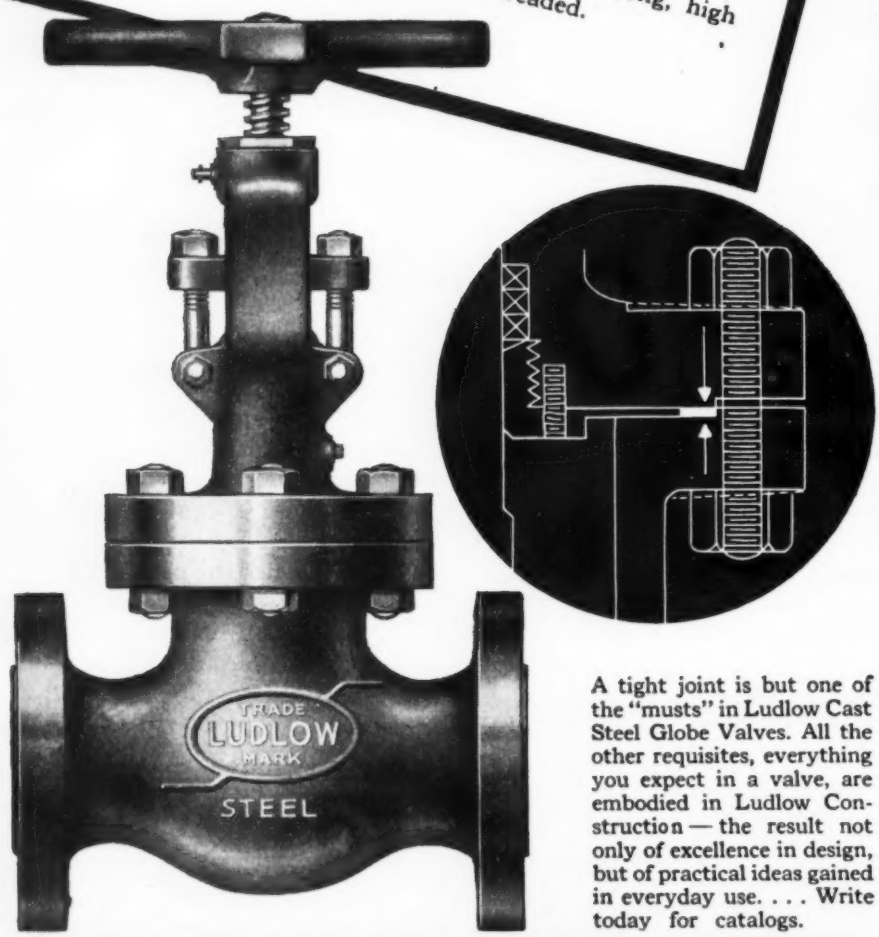
THE YOUNGSTOWN SHEET AND TUBE COMPANY
YOUNGSTOWN, OHIO
Manufacturers of
CARBON - ALLOY AND YOLOY STEELS
Pipe and Tubular Products - Sheets - Plates - Conduit-Bars-Coke Tin Plate-Electrolytic Tin Plate-Rods-Wire-Nails-Tie Plates and Spikes.

"Swap a pencil for a wrench and you'll get ideas on bolting a bonnet joint."

Right! That's why LUDLOW STEEL GLOBE VALVES have:

- Throat flange bolting spaced to prevent distortion when bolting joint.
- Liberal gasket compression maintained by method of throat flange bolting.
- Through-bolts with ample wrench clearance.
- Throat flange bolts are extra strong, high tensile steel, continuously threaded.

G-4



A tight joint is but one of the "musts" in Ludlow Cast Steel Globe Valves. All the other requisites, everything you expect in a valve, are embodied in Ludlow Construction — the result not only of excellence in design, but of practical ideas gained in everyday use. . . . Write today for catalogs.

The LUDLOW VALVE SINCE 1866
MFG·CO·INC·TROY·N·Y·

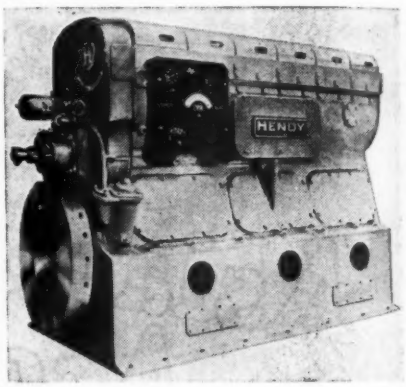
New Equipment

(*Continued from page* 126)

nished as ammeters, voltmeters and wattmeters in both portable and switchboard designs, flat compensated up to 1000, 2000 and 3000 cycles. *Weston Electrical Instrument Corp, 617 Frelinghuysen Ave, Newark 5, N. J.*

Diesel Engines

SERIES 20 DIESELS in 6- and 8-cylinder models with a power range of from 190 to 250 hp at 900 rpm were added to diesel-engine line. Like the Hendy Series 50 engines, the D-26 and D-28 are in marine, stationary and diesel-electric models and are 4-stroke cycle single-acting 7¼x8½ in. units, for heavy-duty medium-speed operation. Also like the larger engines, they



are air starting and completely inclosed, with overhead camshaft, unit fuel pumps and injectors, precision bearings and full-pressure lubrication. Marine models are direct reversing.

New engines have cast-iron mono-block construction with under-hung crankshaft, removable cylinder liners and auxiliary drives arranged at either end. They are entirely self contained, with all main accessories engine mounted. Among the attached accessories are air compressor, governor, water and lube-oil circulating pumps, fuel-transfer pump, lube- and fuel-oil filters, lube-oil cooler and gage board.

Optional engine equipment includes clutch power takeoffs, engine-mounted generator, pyrometer and thermocouples, automatic alarm or shutdown equipment, overspeed governor and, on the marine engine, sailing clutch and bilge pump. Series 20 engines are also available as complete electric generating units or as marine auxiliary units with generator, compressor and pump. *Joshua Hendy Iron Works, Sunnyvale, Calif.*

Glass Fiber Mats

THIN, POROUS MATS of bonded glass fibers, originally developed as retainer mats in storage batteries, have now been successfully applied to new fields. Primarily because of high-tensile strength and nonhygroscopic characteristics of industrial glass fibers, the *Fiberglas* mats are being em-

● *Built by* REEVES PULLEY CO.

CLOSE *Relations!*

The relationship between the continuous, smooth, quiet operation of this Vertical Enclosed Design Transmission and SKF Performance is very *close*. For on the vital moving parts of this unit are SKF Bearings keeping shafts properly positioned, running steadily with practically no wear, and maintaining high standards of performance. Recognizing the dependency of smooth *machine* performance upon smooth *bearing* performance, engineers everywhere indicate their preference for SKF Bearings by using them.

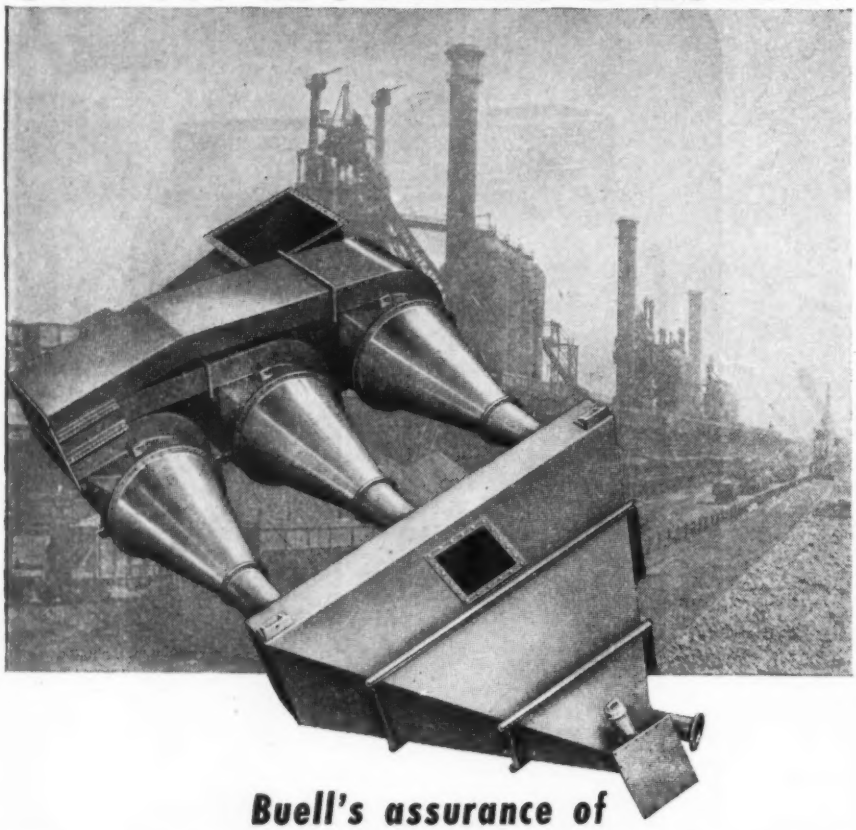
5822

SKF INDUSTRIES, INC., PHILA. 34, PA.

SKF

BALL AND ROLLER BEARINGS

Correct HOPPER DESIGN



Buell's assurance of

HIGH EFFICIENCY, LOW MAINTENANCE, LONG LIFE

TOO OFTEN OVERLOOKED by engineers and operating men is a mechanical feature of *first importance* in the efficient collection of dust: *correct hopper design.*

For example, the correct slope for the particular type of dust collected is an essential engineering "must".

With correctly engineered slopes precisely calculated to overcome any "angle of repose", Buell's overall hopper design and specifications ensure unfailing facility of disposal.

Every Buell hopper sustains the enviable reputation Buell (van Tongeren) Dust Recovery Systems have acquired through efficient dust collection in a widely diversified field.

BUELL FEATURES

SHAVE-OFF
LARGE DIAMETERS
EXTRA-STURDY CONSTRUCTION
CORRECT HOPPER DESIGN
SPLIT-DUCT MANIFOLDS
INNER WELDS GROUND SMOOTH

RESULT IN

HIGH COLLECTION EFFICIENCY
LESS FAN BLADE WEAR
LOW DRAFT LOSS
LOW POWER CONSUMPTION
HIGH TEMPERATURE RESISTANCE
UNLIMITED CAPACITY
NO MOVING PARTS
FREE DUST FLOW

PRODUCE

HIGH EFFICIENCY
LOW MAINTENANCE
LOW OPERATING COST
LONG LIFE
NO CLOGGING

buell
DUST RECOVERY SYSTEMS

JUST OFF THE PRESS: Buell's new revised book—*"The Buell (van Tongeren) System of Industrial Dust Recovery"*—now in its fourth printing, is just off the press. Write for your copy today.

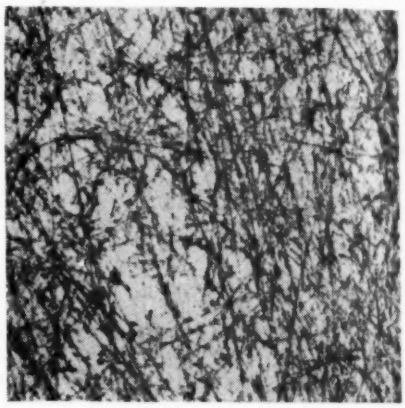
BUELL ENGINEERING COMPANY, INC.
10 Cedar Street, New York 5, N. Y.
Sales Representatives in Principal Cities

DESIGNED TO DO A JOB, NOT JUST TO MEET A "SPEC"

ployed as the base for a new plastic laminated material. Possessing a low and stable loss factor over a wide-frequency range, the laminate extends field for plastic coil forms, condenser spacers, stand-off insulators, etc, in high-frequency electronic devices.

In building up the laminate, the *Fiberglas* mats are impregnated with a thermo-setting aniline-formaldehyde resin and are cured under high pressure. In addition to its low loss factor, laminate is said to possess high strength, high-temperature resistance, dimensional stability and resistance to fungus attack. Good machinability is another property of the laminate.

In roll form, Fiberglas mat is employed as a material for wrapping underground oil, gas and other pipelines to protect them against corrosion and electrolytic action. The material can be wrapped around bitumen or coal tar-coated pipe, thus forming a continuous, watertight bond. Glass fi-



bers are noncorrosive to metals. The material has negligible moisture pick-up. Its tensile strength is preserved through a wide range of temperatures and exposure to organic solvents and soil acids.

Fiberglas is also employed as a base material for gaskets and sheet packing. Mat acts as a carrying medium for synthetic resins for applications requiring resistance to heat, oil and acids.

Fiberglas mat is composed of fine glass fibers (photo shows enlarged fibers) intertwined in random orientation and bonded together to form a thin highly porous, felt-like material. Glass fibers have an average diameter of 0.0005 in. Several kinds of binders may be utilized, depending upon requirements of the end use. Mats are produced in thicknesses ranging from 0.010 to 0.050 in., and in standard widths of 22 and 36 in., in roll lengths of 150 and 300 ft. *Owens-Corning Fiberglas Corp, Toledo, Ohio*

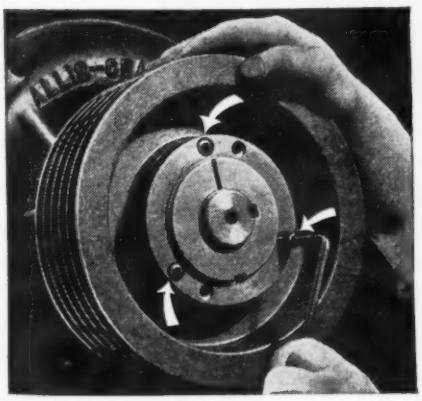
Environment-Proof Switches

TWO METHODS of making switches environment proof for damp or wet places, or where dirt, dust or fumes are present, have been worked out. One is to put a bellows on the plunger end of switch and the other is to place a rubber boot over the plunger. In temperatures down to —40 F, the rubber boot has been satisfactory under many conditions. However, where hydraulic fluids and gasoline or other solvents are present, or where switch will meet extremes of heat and cold, the metal

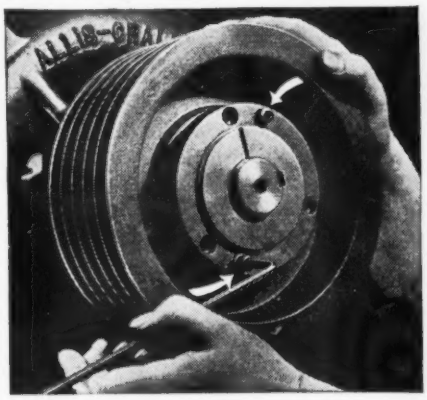
Changing was a job for but now could do it

No bulging muscles needed! Allis-Chalmers' new "Magic Grip" — *fastest mounting and demounting sheave on the market* — slides on and off *easily!*

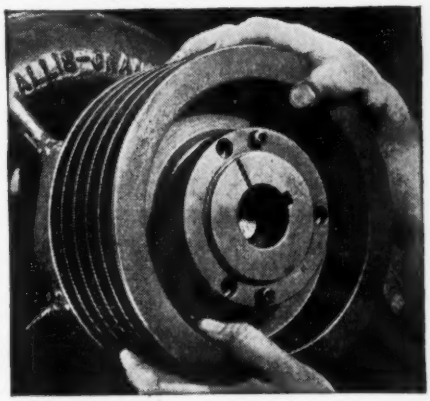
SEE HOW QUICKLY AND EASILY THIS SHEAVE COMES OFF THE SHAFT



1 **Remove three capscrews** from bushing collar. A handy wrench — supplied with each sheave — is the only tool needed to remove Allis-Chalmers' new "Magic-Grip" from motor or machine shaft quickly and easily.



2 **Insert two capscrews** in tapped holes. As screws are turned, they become levers . . . automatically breaking tight grip of tapered split bushing on sheave and shaft. Entire unit is then ready for removal.



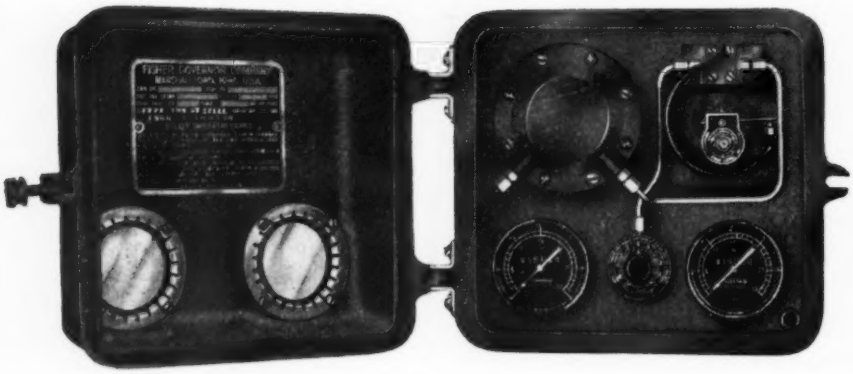
3 **Remove sheave from shaft.** Requires no mallet, no prying, no bulging muscles. You just slide the sheave off . . . smoothly, quickly. *It costs nothing extra!* Send for B6310. Allis-Chalmers, Milwaukee 1, Wis.

A 1856

Allis-Chalmers Texrope

"MAGIC-GRIP" SHEAVES

100% PNEUMATIC PILOT OPERATION IS AN EXCLUSIVE LEVEL-TROL FEATURE



The unique, mechanically simple Level-Trol pilot guarantees maximum sensitivity, dependability, and long trouble-free service whether applied to level control, level indication or interface level control.

(1) It is 100% pneumatic in its operation — all linkage, pivot points, sliding adjustments and other sources of friction eliminated — necessary operating power reduced to a minimum.

(2) Minimum of moving parts to wear out or cause trouble — dependable, trouble-free performance assured.

(3) Intermittent bleed pilot relay speeds action of the diaphragm control valve in response to level change — no measurable lag.

(4) Throttling range adjustment is entirely pneumatic — no gears or sliding levers to adjust — simply turn the adjusting knob in accordance with calibrations on the dial.

(5) Likewise the position of the level at any constant flow rate may be readily adjusted by turning the adjustment knob located in the center of the Bourdon tube.

Type 2400-248, 600 lb. electric cast steel float cage.

Level-Trols are available in a wide range of types and sizes for all fluids and all applications. Write for Bulletin F-1.

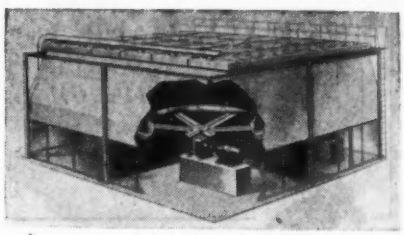
FISHER GOVERNOR COMPANY
439 Fisher Bldg., MARSHALLTOWN, IOWA

bellows is recommended. Most of the switches in line, according to maker, may be made environment proof. Bellows or boot is held on one side of panel and a lockwasher is on other side.

These switches may be furnished with total movement of $\frac{7}{16}$ in. All switches are completely sealed, back and front, and are for ac or dc. Contacts of double-break design, are solid silver. *Robert Hetherington & Son, Inc, P O Box 204, Sharon Hill, Pa.*

Welding Rods

EUTECTRODE 28, a special coated bronze alloy for arc welding of bronze, brass and copper contains an unusual combination of metals and is shielded with a newly devised flux coating that makes it suitable for ac or dc. This electrode deposits dense and tough metal that is a good color match to most bronzes. It gives welded area substantially the same corrosion resistance that these various base metals possess. It may also be utilized for welding copper and brass or joining these metals to steel, cast iron or nickel alloys and for overlaying steel or cast iron to provide a good bearing surface. *EutecTrode* 28 is in $\frac{1}{8}$ and $\frac{5}{32}$ in. dia and can be identified by a light green tip. *Dept A-2, Eutectic Welding Alloys Co, 40 Worth St, New York 13, N. Y.*



Fin Fan Cooling Unit

COOLING SECTIONS, employing K-fin tube construction, are cooled by forced draft fed by air from cooler layer at ground level and supplied by fans with variable pitch blades and with variable-speed drive. Vertical air flow against static head assures even air distribution over cooling surfaces. Fin fan units are for pressures to 5000 psi and temperatures to 1500 F. Coils provide sufficient static head for pump suction. Tubes can be removed and replaced quickly and all mechanical equipment is readily accessible from the ground. *Fluor Corp, Ltd, 2500 S Atlantic Blvd, Los Angeles 22, Calif.*

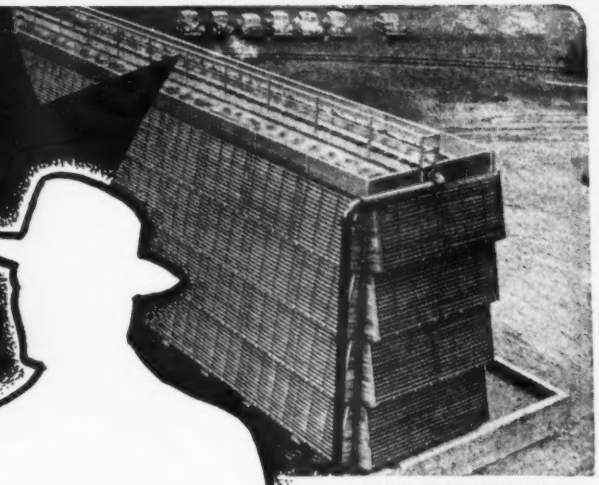
Steam Condenser

NIAGARA AERO STEAM CONDENSER applies greater capacity of evaporative cooling to condensing of water vapor. Apparatus consists of a series of condensing coils that are subjected to a constant and uniform drenching spray while air is drawn across sprayed coils by fans. The spray water is recirculated and only that which is evaporated is consumed. Air is removed from condensate by 2-stage devaporizing coils operated with air ejectors, and the ejector steam is condensed in inter- and after-condensing coils. Pure water vapor can be

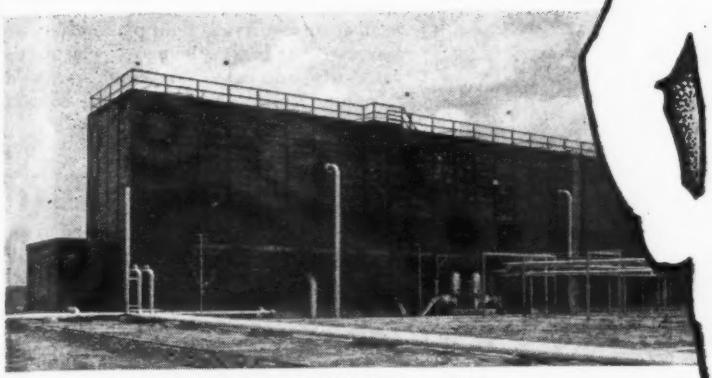
SPRAY NOZZLES for every spraying purpose.

No. 1 Man in COOLING TOWERS

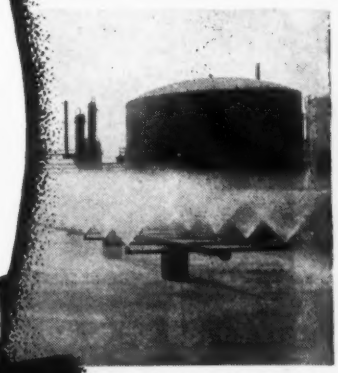
CONVENTIONAL INDUCED DRAFT TOWERS for general service, medium to heavy duty.



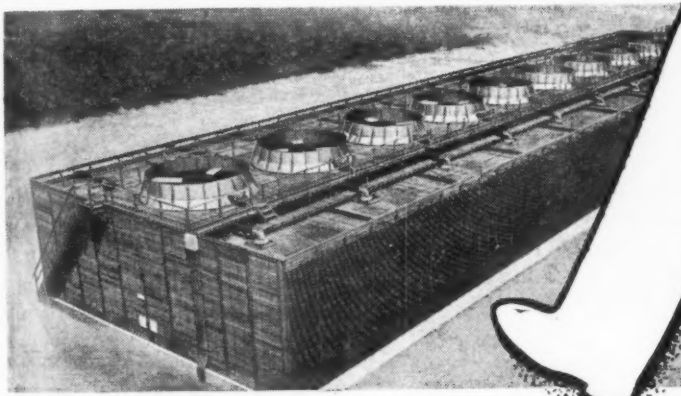
DECK TOWERS with unique Marley features.



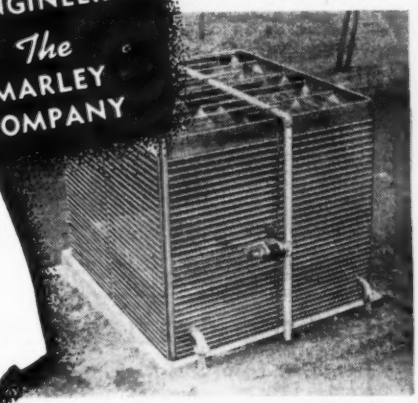
"SpraCoil" INDUCED DRAFT TOWERS for cooling gas, oil and other fluids through sprayed coils.



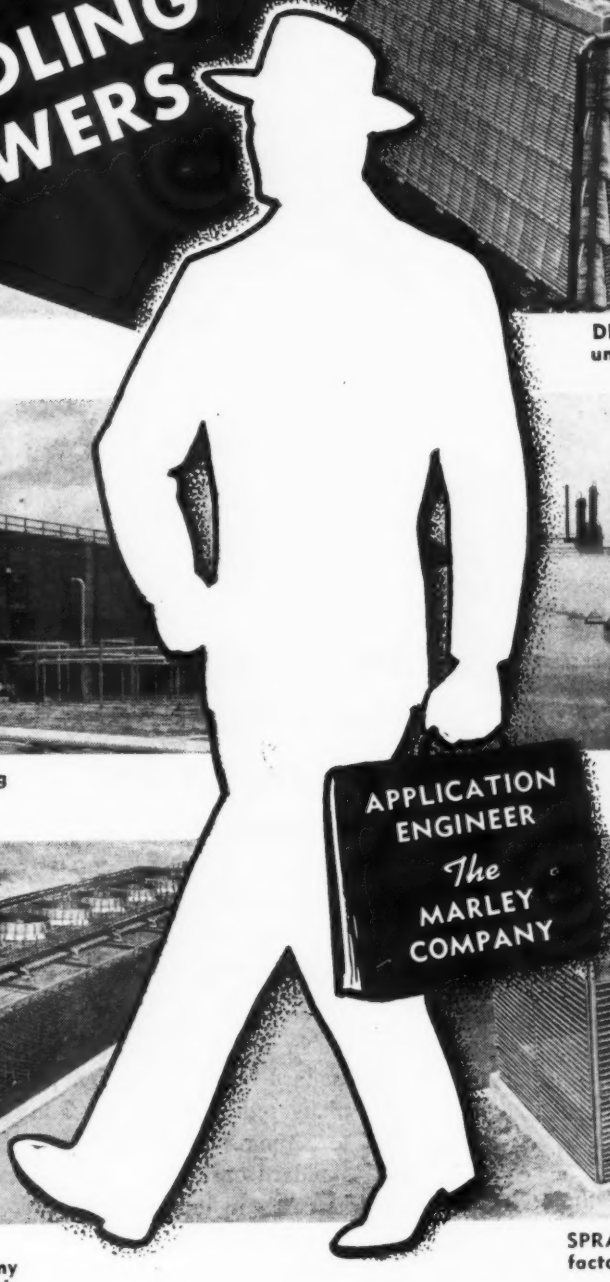
SPRAY PONDS and parts, complete stock.



DOUBLE-FLOW INDUCED DRAFT TOWERS for unusual economy in all heavy-duty applications. Low pumping head.



SPRAY TOWERS for satisfactory service at least cost.



55-A

MARLEY . . . the only complete line of water cooling equipment . . . all types in all sizes . . . a long record of successful applications for every need and condition. The Marley Application Engineer in your area has an unbiased approach to your water cooling problems. Call him for counsel, analysis, recommendations which will *not* be "slanted" in favor of a limited line.

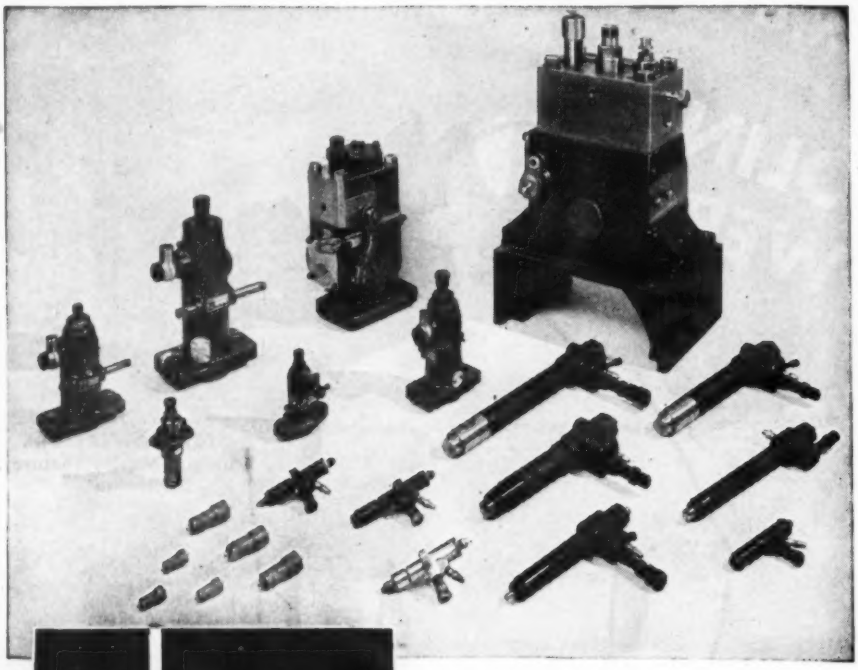
For further information consult SWEET's Catalogs, Chemical Engineering Catalog, Refinery Catalog, ASH&VE Guide, Dairy Industries Catalog, etc.

The MARLEY COMPANY, Inc.

MARLEY COOLING TOWERS

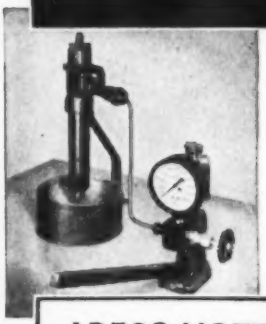
OFFICES in MAJOR CITIES — Consult Telephone Directory

KANSAS CITY 15, KANSAS



adeco..

YOUR SOURCE FOR DEPENDABLE FUEL INJECTION EQUIPMENT



Whether you need standard fuel injection equipment or special units built to your specifications, Adeco offers the logical source of supply.

Today's line of Adeco equipment, the outgrowth of long experience in serving the Diesel industry, includes: Standard fuel injection pumps in plunger diameters from 7 mm. to 31 mm.; a complete line of standard nozzles and nozzle holders, including the water-cooled type; and the Adeco nozzle tester.

All Adeco products are built to highest standards, with years of trouble-free operation behind them to testify to their reliability.

ADECO NOZZLE TESTER

For Low-Cost Maintenance

America's most widely used nozzle tester enables any mechanic to make quick, accurate tests on injector opening pressure, spray pattern, etc., and detect stuck needle valves and leakage around valve seats. Compact, portable, sturdy, precision-built. Pressures up to 10,000 p.s.i. Tests both large and small injectors on bench or engine. Prevents costly delays and possible damage to engine. Standard or Navy-approved gauge. Ideal for testing hydraulic equipment. Write for bulletin.

ADEC

AIRCRAFT & DIESEL EQUIPMENT CORP.

4401 NO. RAVENSWOOD AVE. • CHICAGO 40, ILLINOIS

condensed at vacuum up to 29 in. Capacity of a typical unit at 28 in. of vacuum is 1475 lb per hr; at 25 in. of vacuum, 4050 lb per hr. Units may be installed in series. *Niagara Blower Co, 6 E 45 St, New York 17, N. Y.*

Transparent Tape

FIBRON TAPE No. 3, a transparent, flexible thermoplastic tape, facilitates inspection and servicing of equipment. Useful as electrical insulation, it also protects wiring, cables and equipment against abrasion. Tape is heat sealing, flame resistant, flexible at low temperatures and resists attack by acids, alkalies, moisture, oil, grease and corrosive fumes. With proper adhesives, it may be bonded to fabrics, metal, ceramics, wood and other materials. *Fibron* tapes have been applied successfully as gasketing material, in construction of automotive and aircraft lighting and ignition harnesses and in splicing of plastic-insulated wire and cable. *Irvington Varnish & Insulator Co, 6 Argyle Terrace, Irvington, N. J.*

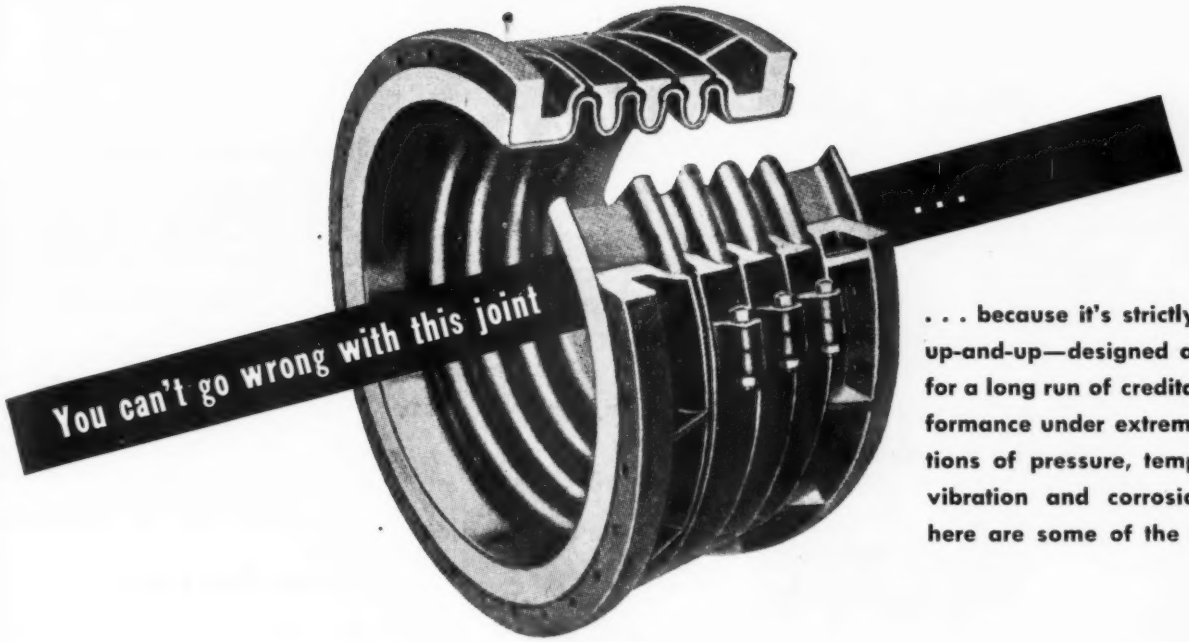
Floor Paint

RUBBERMASTIC PAINT may be applied to wet, damp or dry, painted or unpainted, inside or outside surfaces. No etching or preparation is necessary. Paint can be applied to walls, roofs or floors of concrete, brick, stucco, paper, wood or metal. Its welding qualities effect a vulcanized waterproofing job in colors. *Guaranteed Products, 1117 Crenshaw Blvd, Los Angeles, Calif.*

Emergency Lighting Unit

WHEN USUAL CURRENT SUPPLY is interrupted, *Minuteman Light-Warden* automatically floods the protected area with light from its own power. It can be installed on a post, brackets, shelf or on a platform. No special wiring is required. Just plug into any convenient outlet in lighting circuit.

Minuteman instantly snaps into action on its own, with each lamp head capable of illuminating more than 10,000 sq ft for about four hr. When normal current is resumed, *Minuteman* lamps automatically go out and a built-in charger restores power to battery for next emergency. As unit is self-contained and portable, it can be carried from its regular station for other emergency



. . . because it's strictly on the up-and-up—designed and built for a long run of creditable performance under extreme conditions of pressure, temperature, vibration and corrosion. And here are some of the reasons:

The Badger Packless Corrugated Expansion Joint is more flexible because of its deep annular corrugations. It thus provides more flexing area per given length of joint or number of corrugations. . . . The Badger Joint is longer lasting because (a) its corrugations are ALL-CURVE —without straight sides and angular "junctions" to encourage the localizing of stresses; (b) its corrugations are formed by a uniform Badger method to retain the molecular structure and strength of the metal; and (c) it is specially heat-treated after forming to preserve its flexing qualities. . . . The Badger Joint is more dependable because "form-fitting" ALL-CURVE equalizing rings (exclusive in Badger joints) provide DIRECTED FLEXING. They assure even distribution of stresses—not only throughout each corrugation, but also among all the corrugations of the joint.

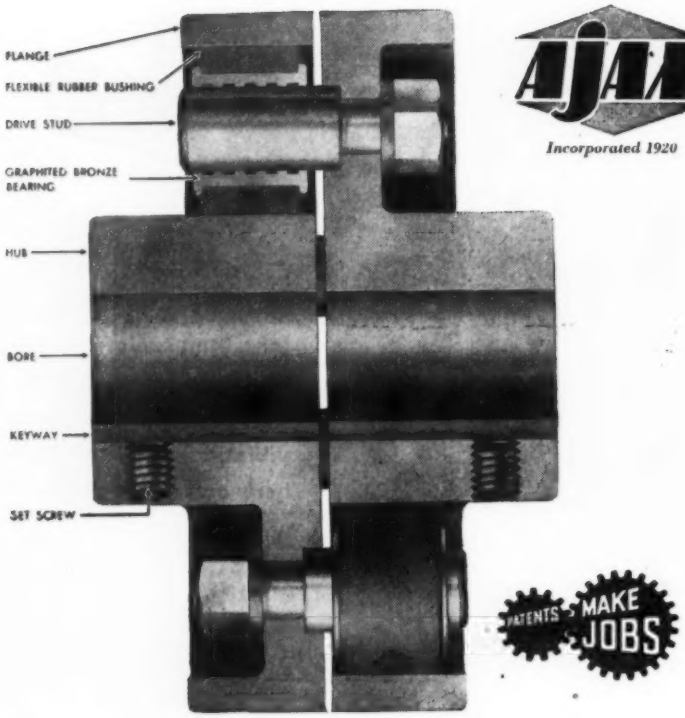
Give yourself the benefit of all the facts about this, the highest quality product of its kind. *SEND FOR FREE BULLETIN No. 100.*

Made in *Copper* for normal pressures and temperatures; in *Stainless Steel* for higher requirements—and where corrosion is a problem. Available in single and multiple corrugations—for traverses from a fraction of an inch upward. Also made in Non-equalizing type (without rings) for uses that do not require this added protection.

E. B. BADGER & SONS CO. • 75 PITTS STREET, BOSTON 14, MASS. • *AGENTS IN PRINCIPAL CITIES*

BADGER packless corrugated expansion joints

IF IT'S **BADGER**-MADE, IT'S **GOT SOMETHING!**



AJAX

Incorporated 1920

The Inside Story of AJAX FLEXIBLE COUPLINGS

Ajax Flexible Couplings protect direct connected machines from unavoidable misalignment. They require no lubrication. They are quiet running — no backlash, no noise. They provide free end-float which permits electric machinery to find its magnetic center. They operate satisfactorily in abrasive-laden air.

They are built in a wide range of sizes and capacities with standard couplings *made of forged steel or cast semi-steel.*

For special requirements flanges can be machined from aluminum, bronze or other metals, and can be plated with chrome, silver or cadmium for protection against adverse atmospheric conditions. Thousands of cadmium-plated Ajax Couplings are running on U. S. Navy equipment throughout the world.

Ajax Couplings can easily be made integral with brake drums, pulleys, fly wheels, etc.

Write for new catalog giving complete data.

AJAX FLEXIBLE COUPLING CO. INC.

WESTFIELD, N. Y.

work. *Minuteman* can also be equipped with a built-in transformer to permit everyday application on regular current supply without draining battery power. *Electric Cord Co, 30 Church St, New York 7, N. Y.*

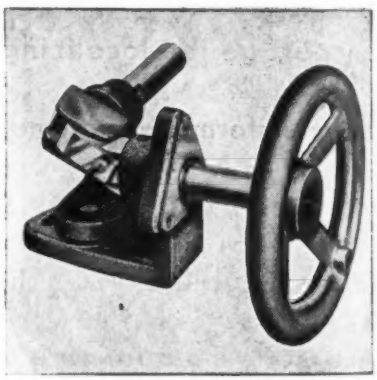
Steam-Cleaning Compound

STEAM-OFF, a heavy-duty steam-cleaning compound, removes heavy, stubborn grease and dirt from iron and steel surfaces, concrete, brick and structural materials, gasoline and diesel engines, steam shovels, tractors, locomotives and road-building machinery.

Compound combines quick cleaning with maximum ability to soften water, which results in producing clean work, rinsing freely and leaving no film, curds, water spots or streaks. Used as a stronger solution, *Steam-Off* removes unwanted painted surfaces as it cleans. *Turco Products, Inc, 6135 S Central Ave, Los Angeles 1, Calif.*

Pressure-Gage Tester

MULTIPURPOSE PRESSURE-GAGE tester is for bench or portable field testing. In bench testing, unit can serve with test gages or with a dead-weight attachment. A unique, but simple, doubly sealed check valve eliminates leakage and loss of pressure whether employing oil or water and for pressure up to 10,000 psi. Principal applications of the testing unit include testing and repairing of pressure gages and instruments, the setting of relief or other pressure-actuated valves and general hydrostatic testing. *Mansfield & Green, Cleveland, Ohio.*



Link Joint

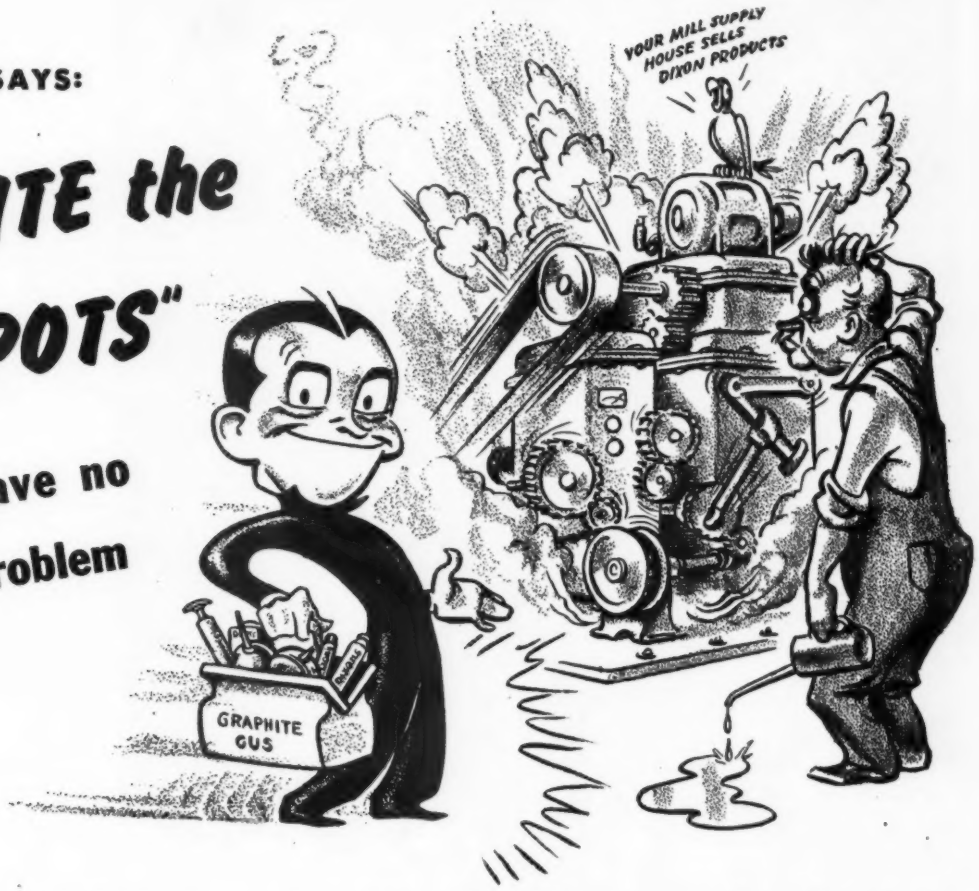
PIEZO UNIVERSAL LINK JOINT features an adjustable link mechanism to transmit rotary motion around corners, permitting operation of shafts at angles from a straight line to 90 deg. With solid shafting and absence of flexing or backlash, this makes an ideal method for accurate remote controls. Output shaft turns in exact angular rotation as input shaft, giving an input turning angle equivalent to the output turning angle. This is of particular importance in dial settings and where uniform motion is desired.

Joint is mounted by three screws which hold it in position. Bearing arm which holds the adjustable shaft may be hinged to any desired position from 0 to 90 deg and when in proper location, a locking screw permanently holds its position. Link

GRAPHITE GUS SAYS:

GRAPHITE the "HOT SPOTS"

and you'll have no lubrication problem



Dixon's Graphited Greases and Oils handle excessive heats, pressures and speeds ordinary lubricants can't cope with

Dixon's Cup & Pressure Gun Graphited Grease. This all-purpose water-insoluble lubricating grease does a super lubricating job under all conditions of extreme heats and pressures. Why? Because the lubricating flake graphite in it coats metallic surfaces into sleek frictionless surfaces that resist wear. Data sheet #13 tells "where and how".

Dixon's L & P (Lubricating and Penetrating) Graphited Oil. A long-lasting oil combining exceptional qualities. It gets in where ordinary oils can't. It deposits a tough, oily graphite film to fight-off friction. Lubricating flake graphite fortifies it for extreme heat conditions. Also works fast in loosening rust-tight assemblies. Data sheet #16 "tells all".

Dixon's Auto-Marine Packing and Cup Graphited Grease. A heavy-bodied bearing packing grease of maximum stability under extremes of both heat and cold. Will not thin down, wash out, or emulsify in fresh or salt water. Graphite gives it a stamina that ordinary greases can't equal. Data sheet #17 gives details.

Dixon's Graphite SlipStik. This little 3-inch cylinder has 1001 uses throughout plant, office, home,—wherever quick, handy rub-on lubrication is needed. Won't leak out or gum up. Data sheet #25 tells about it—but, why not stop in at your supply or hardware store and pick up one—15¢

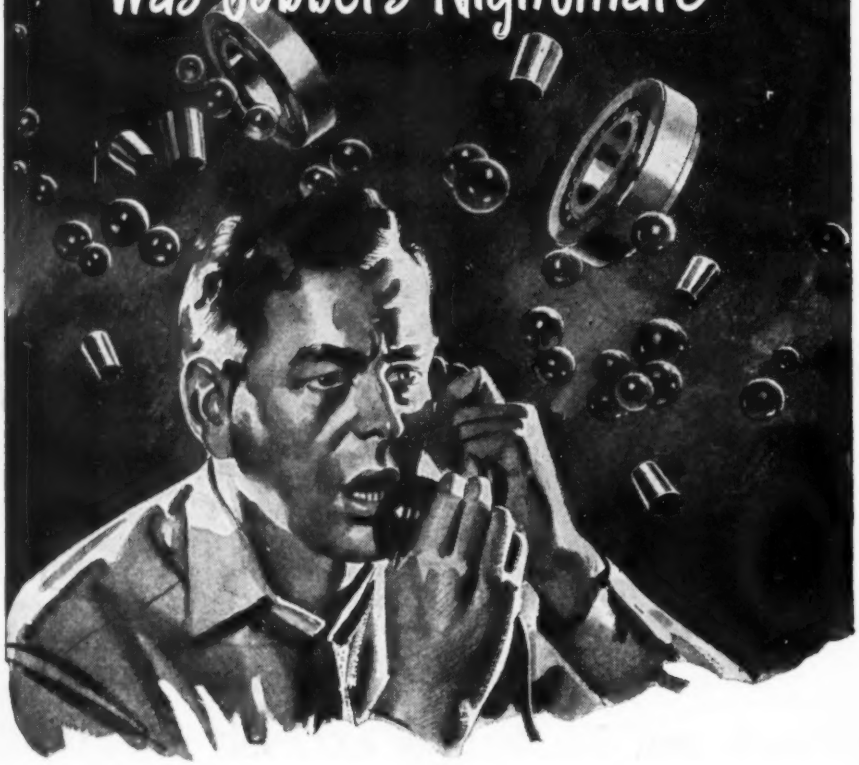
ANSWERS! HELPS! HINTS!

Want help on tough lubrication problems? Send for these illustrated data sheets and see how and where Graphite will help you do a better job. Write Graphite Gus.

JOSEPH DIXON CRUCIBLE COMPANY

DIV. 94C8 **JERSEY CITY 3, NEW JERSEY**

Cost of Special Bearings was Jobber's Nightmare



Air Express solves his problem — for 5% of selling price!

Maybe *your* business isn't like this. Maybe it is. A lot of them are. Anyway, here's this jobber's story:

He stocks a standard line of precision bearings—a big investment. If he had to carry *all* special types and sizes, his investment would run into a nightmare of high-cost slow-turn "specials."

So in order to give 100% service, what does he do? Simply this. When a customer wants a "special", the jobber wires the manufacturer and has the order shipped Air Express. Same-day delivery is often made on orders placed early in day.

Cost of Air Express? Only 5% of his selling price — and on goods he doesn't have to carry!

Specify Air Express-a Good Business Buy

The inventory of any supplier in the nation is within a matter of hours of your business when you specify this fastest delivery service.

Shipments travel at a speed of three miles a minute between principal U. S. towns and cities, with cost including special pick-up and delivery. Same-day delivery between many airport towns and cities. Rapid air-rail service to 23,000 off-airline points in the United States. Direct service to scores of foreign countries.

AIR MILES	2 lbs.	5 lbs.	10 lbs.	25 lbs.
250	$1.04	$1.25	$1.57	$2.63
500	$1.11	$1.52	$2.19	$4.38
1000	$1.26	$2.19	$3.74	$8.75
2500	$1.68	$4.20	$8.40	$21.00

AIR EXPRESS

GETS THERE FIRST

Write Today for interesting "Map of Post-war Town" picturing advantages of Air Express to community, business and industry. Air Express Division, Railway Express Agency, 230 Park Avenue, New York 17. Or ask for it at any Airline or Express office.

Phone AIR EXPRESS DIVISION, RAILWAY EXPRESS AGENCY
Representing the AIRLINES of the United States

joint is for hand operation and slow-speed power drives, such as control of electrical switchboards, valve operation, etc. *Piezo-electric Corp, 110 E 42nd St, New York 17, N. Y.*

Direct-Fired Heater

COMPACT, HEAT-PRODUCING and distributing unit burns either gas or oil. Warm air from heater can be discharged in any direction by regulating adjustment of nozzles. There are directional louvers on each nozzle to channel the flow up or down. Adjustable nozzles drive hot air at velocities of 1800 to 2000 ft per min, enabling the heaters to be located from roof trusses or wall brackets 30 or more ft above floor, and still deliver their heat load efficiently to working area.

Btu output per hr capacities range from 300,000 to 1,650,000, depending on heater size. Combustion takes place in tear-drop-shaped combustion chamber, lower half of which is lined with plastic refractory molded to metal wall. An ingenious system of passes brings air to be heated in contact with heating elements four times. Heaters are shipped complete with refractory lining and all wiring in place, which simplifies installation. *Dravo Corp, Pittsburgh 22, Pa.*

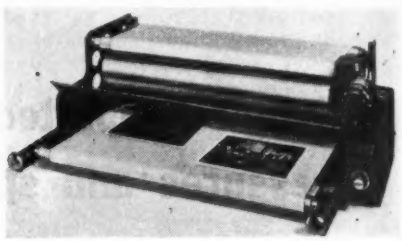


Photo Dryer

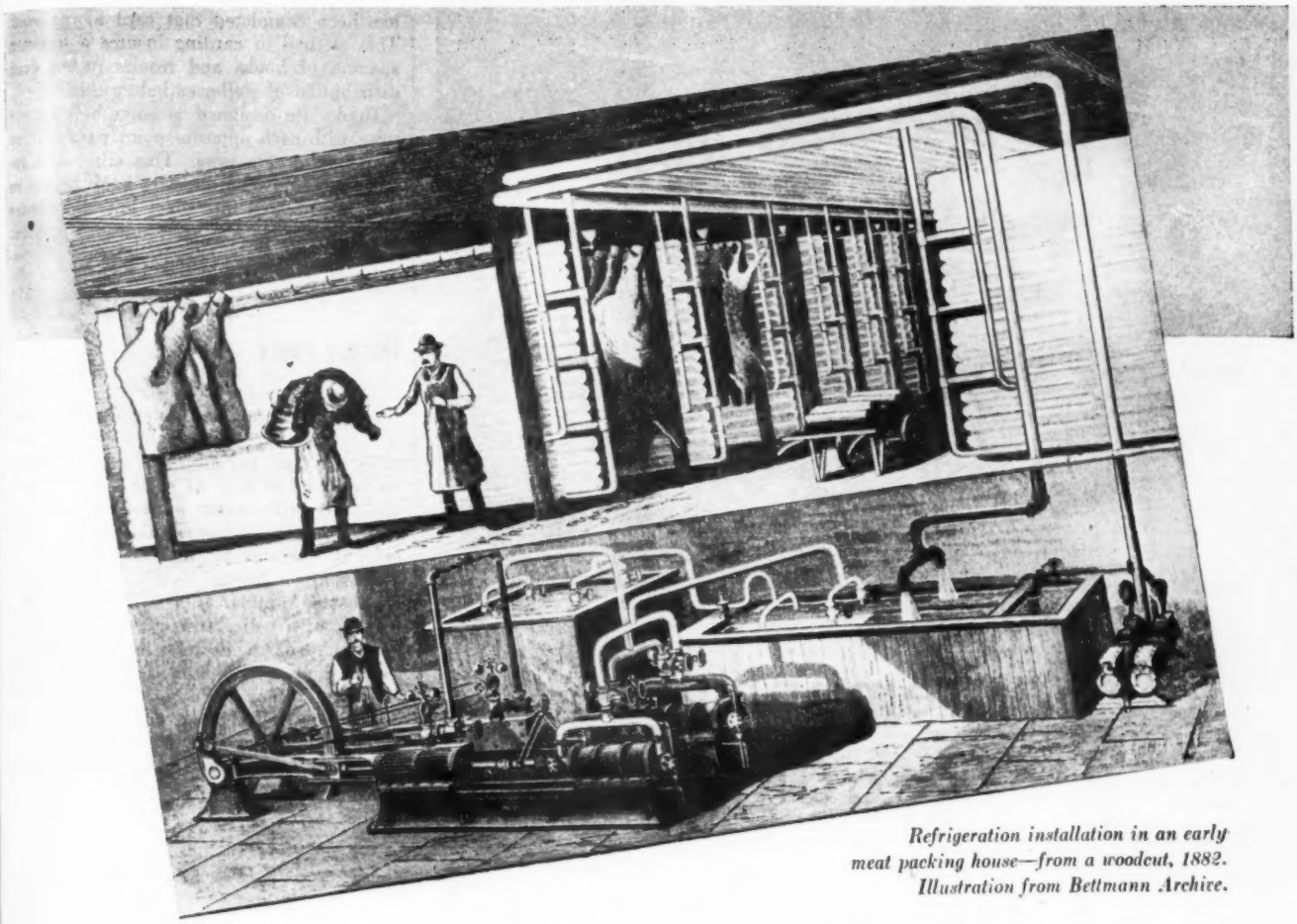
B-8 PHOTO DRYER operates with additional electrical-heating elements that assure maintenance of even heat. It dries matte or semi-matte prints or glossy prints, as well as blueprints or black-and-white prints. Variable-speed-drive motors and controllers permit instantaneous speed changes over a range of 6 in. to 3½ ft a min. Chromium-plated copper drum finishes photos with high-glossy surface.

Two sizes are available: The 26-in. dryer, 110 v, ac or dc, is 40 in. long, 28 in. wide and 13 in. high. The 44-in. dryer, 110 v, ac or dc, is 58 in. long, 28 in. wide and 13 in. high. Both are complete with receiving tray for dried prints. Thermostatic control is optional. *Peck & Harvey, 4327 Addison St, Chicago 41, Ill.*

Wire Belt Hooks

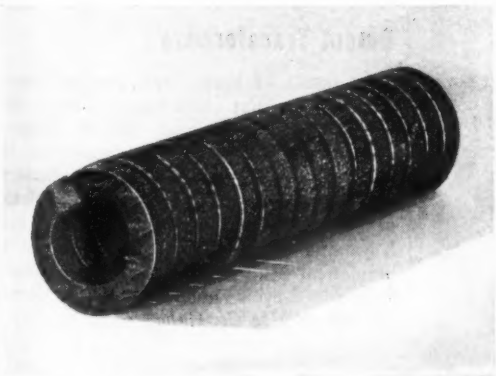
HINGED WIRE BELT HOOKS join all flat belting, including leather, fabric, rubber and balata belts. Various sizes are offered to take care of belts up to ⅜-in. thickness.

A new method of mounting the hooks in the spacer card makes it possible to leave card in place in lacing machine during lacing operation. Hooks are thus held in accurate alignment until hook points pierce belt. It is not until after lacing operation



Refrigeration installation in an early meat packing house—from a woodcut, 1882. Illustration from Bettmann Archive.

Refrigeration Installation Back in 1880



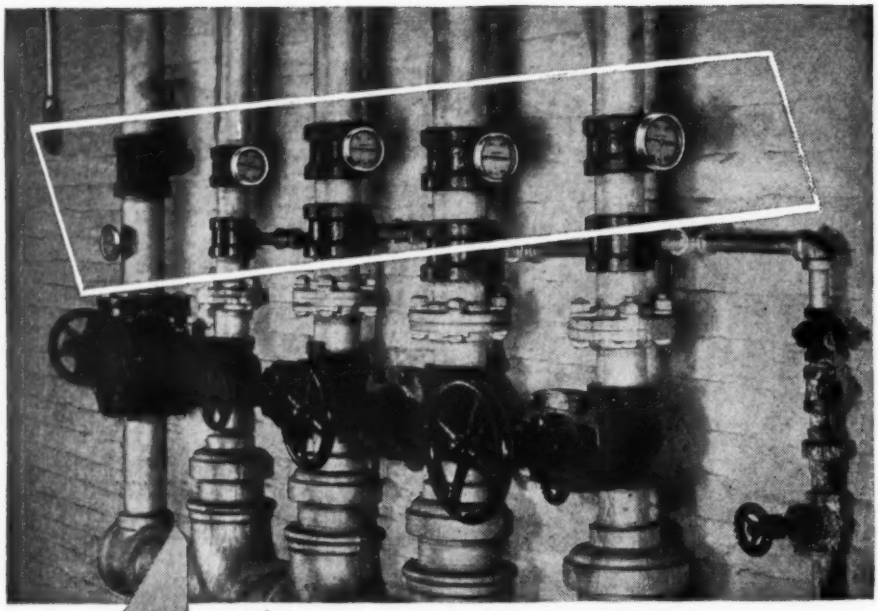
GARLOCK 778 (*illustrated*) is an ammonia packing made of closely woven duck and rubber. Other Garlock packings for ammonia service are of metal foil or semi-metallic construction.

The development of centralized refrigeration methods shortly after the Civil War gave rise to the modern meat packing industry. Then, as today, continuous operation of cold storage equipment was vital.

GARLOCK Packings and Gaskets were used in refrigeration plants and many other infant industries over a half century ago—and today GARLOCK products are used in *hundreds of different industries*, helping to keep production running efficiently by reason of their long life and dependable performance.

THE GARLOCK PACKING COMPANY
PALMYRA, NEW YORK
In Canada: The Garlock Packing Company of Canada, Ltd., Montreal, Que.

Garlock

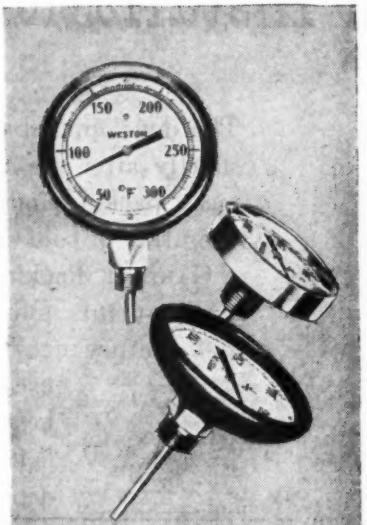


4 Temperature Readings... at one glance!

WITH READABLE, RELIABLE
WESTON ALL METAL THERMOMETERS

Readability does it... whether its single or multiple temperature readings... in dark corners, in hard-to-get-at places, or spots high overhead... Weston All-Metal Industrial Thermometers are "kind to the eyes". Their bold, gauge-type scales are quickly and accurately read, even a distance away.

And for accuracy and all-round ruggedness, too, you can depend on their sturdy, yet simple, all-metal construction. The only moving part is the all-metal temperature element—and that is safely enclosed in a stainless steel stem. Thus the high initial accuracy of the WESTON thermometer... within 1% over the entire scale... is maintained over long periods; despite shock, vibration or other severe usage. Literature gladly sent on request... Weston Electrical Instrument Corporation, 679 Frelinghuysen Ave., Newark 5, N. J.



Available in stem lengths from 2½" to 48" . . . ranges from + 1000° F to — 100° F ... scale lengths 6", 9", 12".

Weston *All Metal* **THERMOMETERS**

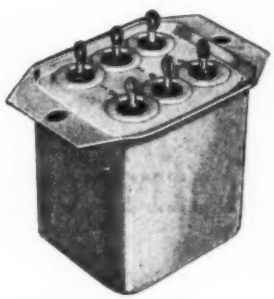
has been completed that card is removed. This method of carding insures a uniform spacing of hooks and results in an even distribution of pull-over belt width.

Hooks are designed to enter belt in two rows with each opposite point passing into belt in alternate rows. This eliminates interference between opposite hook points as they are pressed into place and distributes the grip on the end of belt over a greater area. *Mill Supply Div, Bristol Co, Waterbury 91, Conn.*

Rotary Pump

LOW-CAPACITY close-coupled rotary pump is for pumping water or other liquids under high pressure. With capacities ranging from ¼ to 8 gal per min, this pump operates on vacuums as high as 26 in. and operates efficiently with water up to 500 psi; for oils or other viscous liquids up to 1000 psi. It operates at full motor speed of 1750 rpm on lighter liquids, or 1200 rpm on heavier liquids.

Of positive-displacement design, this new pump has a mechanical seal. Shaft is mounted on ball bearings. Pump may be furnished either with or without built-in bypass and relief valves. It is made of various metals according to the job's requirements. *Bump Pump Co, La Crosse, Wis.*



Output Transformers

NEW SERIES of hermetically sealed aluminum-case output transformers have annealed steel cores and special vacuum-impregnated coils which, according to manufacturer, improve operating efficiency and general over-all performance. Terminals of Pyrex glass, with Kovar electrodes and Kovar metal collars, are said to form a hermetical seal that complies with standards for 5-cycle immersion tests. *Acme Electric & Mfg Co, Cuba, N. Y.*

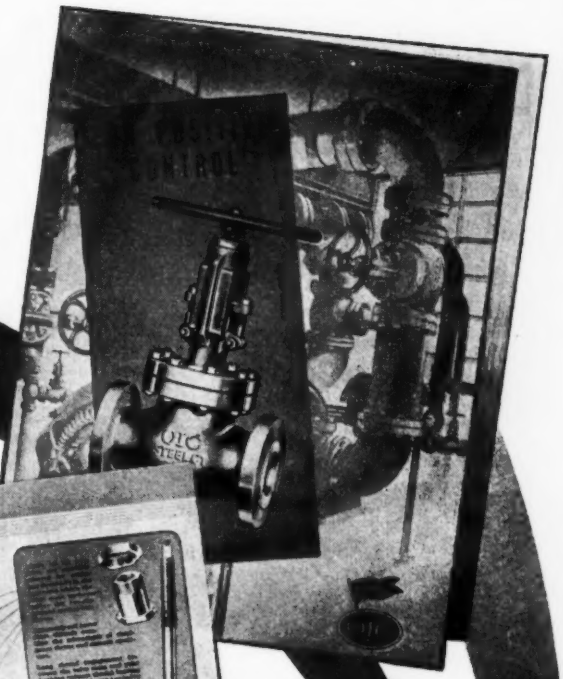
Electrode Holder

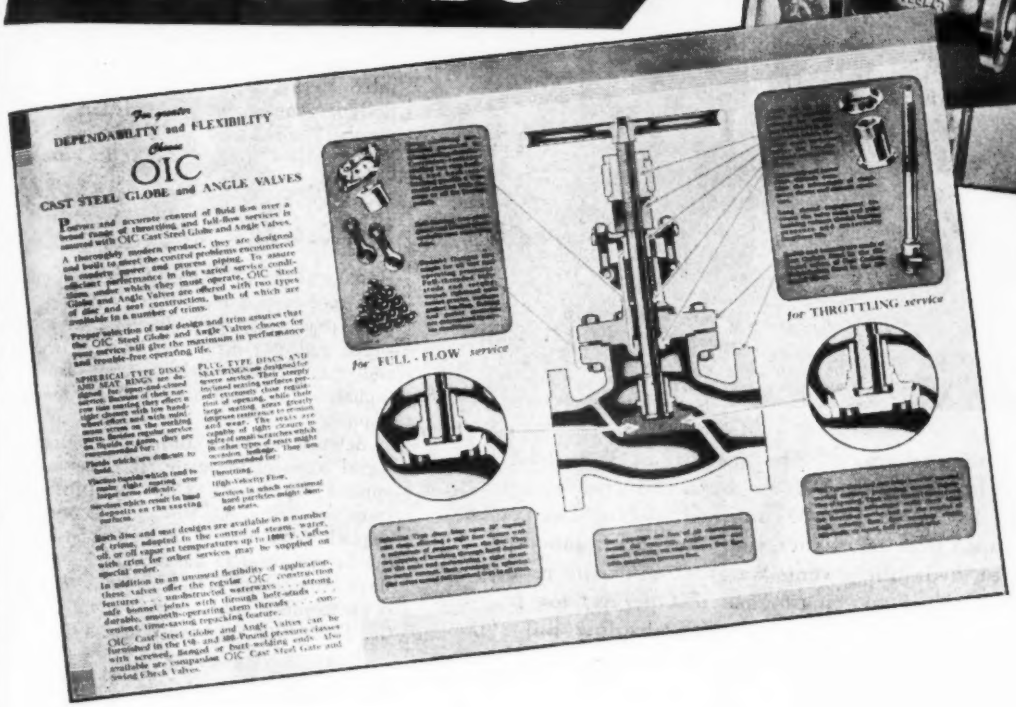
HEAD OF NEW SCREW-TYPE fully insulated electrode holder is completely inclosed in a sheath of aluminum armor. This armor protects the insulation, resists weld spatter and eliminates possibility of acidental contact with welding circuit.

Designed for electrodes up to and including ¼ in. in dia, lightweight holder is easy to use and unusually cool in operation. Slight twist of the hand tightens or releases the electrode. Holder firmly grips the electrode at the proper angle and good current contact is maintained. This keeps holder cool, tends to prevent over-heating of elec-

Something New

IN CAST STEEL — GLOBE *and* ANGLE VALVES





OIC

IT WILL pay you to look into the complete line of OIC Cast Steel Valves . . . for they *are* different.

You will find a RIGHT OIC Valve for every application with the right combination of trims to give you the best performance.

Take, for example, the OIC Cast Steel Globe and Angle Valves that assure you greater dependability and greater flexibility . . . positive and accurate flow control . . . maximum performance . . . longer trouble-free operating life.

These great OIC Valves are completely described in our new brochure No. 357.

Why not send today for this brochure and get the inside story of the superior service these valves will render?

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O. I. C.
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Wadsworth, Ohio

Send me copies new OIC Brochure No. 357 on OIC Cast Steel Globe and Angle Valves . . . also name of OIC Distributor nearest to me.

Name .....

Company .....

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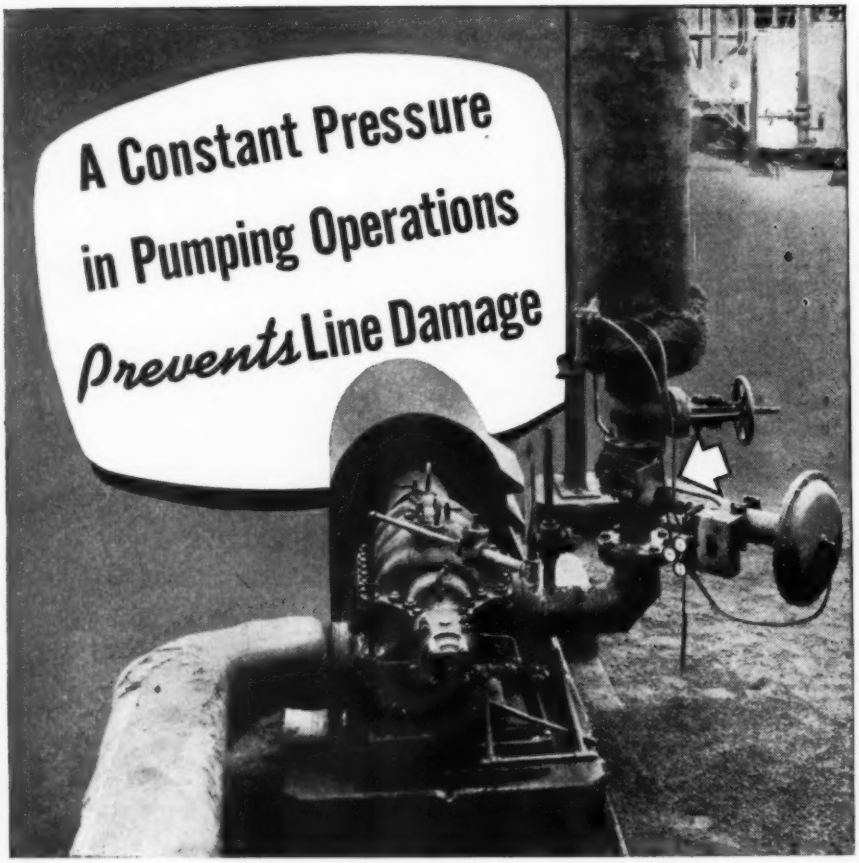
THE OHIO INJECTOR COMPANY
WADSWORTH, OHIO
Quality Leaders in Valve Manufacture Since 1883



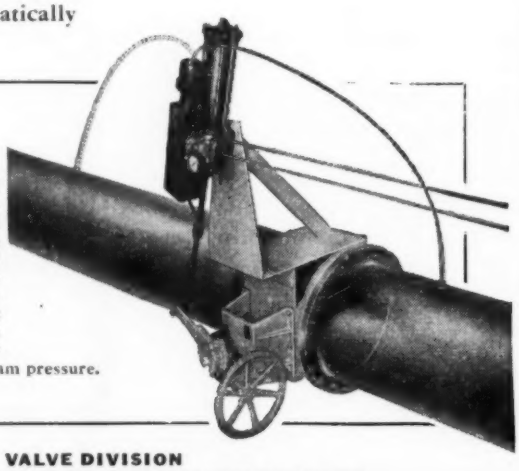
The upstream or downstream pressure in a line can be controlled automatically by an R-S Butterfly Valve, equipped with an air diaphragm, oil or hydraulic positioner cylinder attached to the valve. If the line pressure decreases, the valve vane slowly closes until the predetermined line pressure has been reached, at which time the vane automatically reopens.

The use of an R-S Butterfly Valve as a main control valve provides unexcelled flow characteristics, simplifies performance, prevents water hammer and reduces maintenance. Operates for pressures between absolute and 900 pounds gauge.

Write for Catalog No. 14-B.

No. 501

125-pound American Standard R-S Valve equipped with declutching unit (patent applied for) which permits operation of the valve with the hand wheel. Only four to six revolutions of the hand wheel are required for complete opening or closure. The dotted lines indicate the piping necessary to maintain a constant upstream pressure.



VALVE DIVISION
R-S PRODUCTS CORPORATION
4536 Germantown Ave. • Philadelphia 44, Pa.

R-S Streamlined BUTTERFLY VALVES

trode and maintains a uniform melting rate clear down to a stub end. The threads of the push-up rod do not carry current. A soldered cable connection also helps the holder to remain cool. Width of electrode slot limits size of electrode that can be inserted, thus preventing overloading. *General Electric Co, Schenectady 5, N. Y.*

Coal-Slicer Hoist

MODEL TWWX 2-drum electric hoist raises and lowers a slicer bar which chops up coal so that it flows freely through underside trapdoor into hopper of conveyor. The coal-slicer bar, in combination with the hoist, also helps to move coal from various pockets of the hopper car to the open bottom. There is fast and clean unloading of coal which formerly required a considerable amount of manual labor. Motor is rated 30 hp, high torque, high-slip hoist design, continuous duty, fan cooled, weatherproofed and fitted with an electric brake. *Silent Hoist & Crane Co, Brooklyn 20, N. Y.*

Roof Coating

HORNLUME PUTS ASPHALT and aluminum on a roof in one operation. *Hornlume* contains practically pure metallic aluminum, which reflects ultraviolet rays of the sun and thereby keeps them away from the asphalt. Sun's heat and light are reflected. Asphalt rests secure beneath this first line of defense. Asphalt and aluminum are integral parts of the material. They are not applied separately. They are brushed on from one can, at one time, in one operation. Asphalt takes up its protective position at the bottom, next to the roof, and aluminum stays on top and faces the sun. *Hornlume* is an insulator and a reflector. *A C Horn Co, 43-36 10th St, Long Island City, N. Y.*

Arc-Welding Electrode

TYPE W-56 HEAVILY COVERED arc-welding electrode operates satisfactorily on either ac or dc reverse polarity and its current range is sufficiently broad to cover a wide range of plate thicknesses. A medium-long arc is recommended for best results with this electrode. Available in sizes $\frac{1}{8}$, $\frac{5}{32}$ and $\frac{3}{16}$ in. in dia, it may be used in flat, vertical and overhead positions. It produces a relatively flat deposit particularly in vertical position.

Features include a stable spray arc, deep penetration and good creep-resisting qualities. In addition, the covering produces an easily removed, light, friable slag, which sets up fast, thus facilitating proper manipulation of the electrode. *General Electric Co, Schenectady 5, N. Y.*

Oil-Immersed Contactor

FOR HEAVY-DUTY motor-starting service, MO oil-immersed contactor is built in 100- and 200-amp sizes and can be used with motors rated up to 900 hp at 2300 v. Steel-frame construction is said to insure greater rigidity and perfect alignment of parts. An E magnet and an ac coil with armature directly connected to contactor

ENGINEERED

FOR PRODUCT AND MACHINE DESIGN

One of the most vital spots in production machinery and in many other engineered products is the feed line system . . . the hose or tubing which carries coolants, hot water, steam, compressed air, solvents, gases, chips, dust, etc. This is especially true when such feed or exhaust lines connect moving parts . . . where both enduring strength and extreme flexibility are equally necessary.

The solution of the problem definitely calls for Metal . . . AMERICAN Flexible Metal Hose and Tubing which combines the strength of metal with the flexibility of rubber for long life under even the most exacting conditions.

While American's engineers have designed thousands of special assemblies of tubing and couplings for specific duties, there are among them an infinite number of combinations which will solve almost any conceivable requirement for flexible connectors. When you consider that the cost of *one* "down-time" of a production machine, due to piping failure, will pay for the *best* Flexible Metal Tubing feed line system . . . it's time to specify "AMERICAN."

ASSEMBLIES

We show here a few special and standard assemblies of both American "Seamless" and strip wound tubing, together with the required couplings. Standard types are "Steamtite Connectors," used as steam lines on laundry presses; "Vibration Eliminators" for insertion in rigid pipe lines; and "Bracket-ubes," permanent steam connections on molding presses. Special assemblies cover so many applications that we can only say . . send us your blueprints for specific recommendations . . . our Engineering Department is at your service.

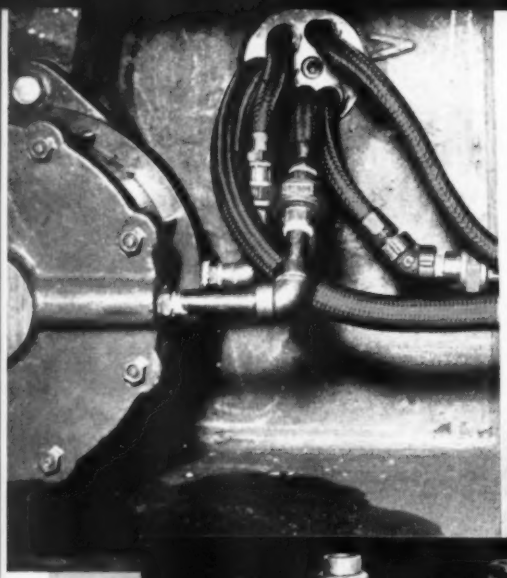
ANACONDA
from mine to consumer

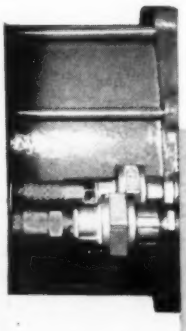
American Metal Hose

AMERICAN METAL HOSE BRANCH of THE AMERICAN BRASS COMPANY

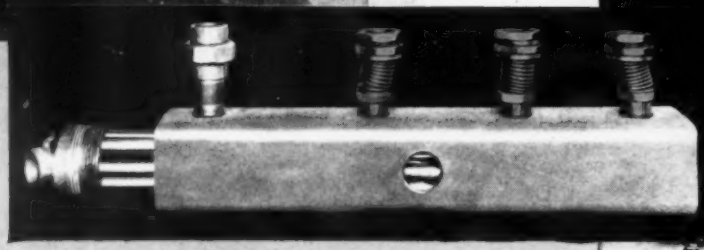
General Offices: Waterbury, Conn. Subsidiary of Anaconda Copper Mining Company

In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

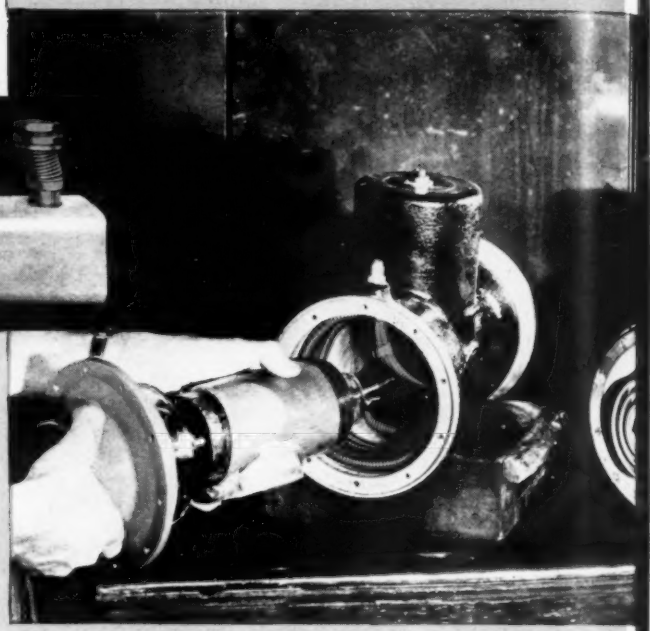




Left: High pressure air lines had to be fitted into a cramped space but the designer of this tube beader found the answer in American Seamless. Photo courtesy: Vaill Engineering Co.



These short flexible assemblies proved to be the solution in connecting this "Header-Heater" to sectional boilers. Flexibility Compensates for differences between Tappings. Photo courtesy: Burnham Boiler Corp.



American Seamless bends to small diameters and easily fits the "profile" of this x-ray tube while conveying water to cool the tube. Photo courtesy: Machlett Laboratories.

DESIGNED RIGHT FROM THE START

From the standpoint of feed lines, many of the country's leading machine and product designers are making sure of smooth functioning by getting American Flexible Metal Hose and Tubing on the drawing boards . . . "Right" . . . from the start.

American Flexible Metal Tubing contributes to operating efficiency in many ways. It has strength beyond other materials . . . flexibility that makes it last even after millions of constant flexings; it will absorb machine vibration; it is easily installed; it can be made of alloys that resist corrosion, abrasion, gases, extremes of temperature . . . it easily handles oil, steam and many chemicals; some types can be bent to any desired position and will "stay put."

American Flexible Metal Hose assemblies are frequently used to connect and compensate for misaligned tappings . . . some are used as protective sheathing for delicate wiring or capillary tubing in recording instruments, X-ray machines, electrical appliances, etc. We will gladly send you bulletins and technical literature covering our products . . . or submit your specific problem to our Engineering Department for recommendations.

The "Life Lines" of your product or machine should be American. Get them "Right" . . . from the start. 45256

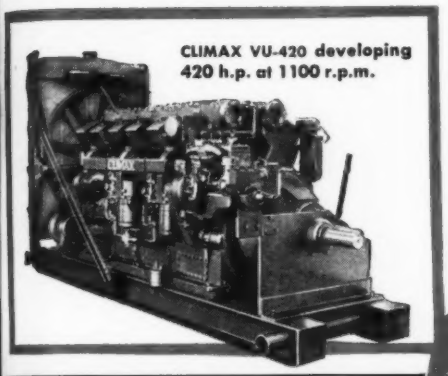
AMERICAN METAL HOSE BRANCH OF THE AMERICAN BRASS CO.

General Offices: Waterbury 88, Conn. • • Subsidiary of Anaconda Copper Mining Company

ANACONDA

In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

THE ENGINE for the job!



climax
BLUE STREAK ENGINE
Builder of Climax DIESELS and GENERATING SETS

CLIMAX ENGINEERING COMPANY

IN-LINES...V-TYPES...DIESELS...Compact Economical Work Engines for Every Power Need from 6 to 495 Horsepower

DISTINGUISHED for service records of 15, 20 and 25 years of heavy duty service—up to 24,000 hours with no major overhaul—sturdy, precision-built Climax Engines deliver unfailing, day-by-day, low-cost power to boats, locomotives, pumps, blowers, compressors, conveyors, hoists, electrical generators, construction equipment, cranes, power shovels, drag lines, rock crushers, power saws, oil well deep-drilling rigs, pipeline pumping stations, etc.

* * *

In Climax Engine Driven Generating Sets—Models from 5 kw to 250 kw—they supply power and light, for less than 1 cent per kw, to schools, airports, construction jobs, etc., and dependable, instant-starting standby service to industrial plants, sewage plants and water works, institutions and public power stations.

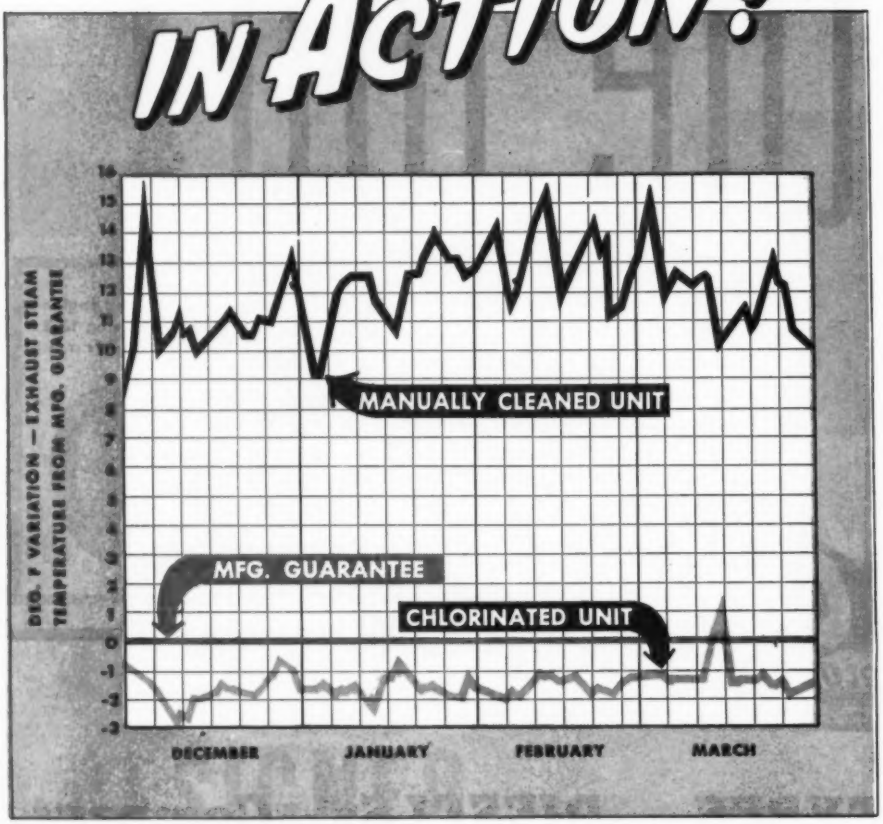
They are built to operate on lowest cost, available fuels, the Diesels (20 and 40 h.p.) on Diesel fuel oil, the Blue Streak models on natural or by-product gas, on butane or gasoline. From the smallest to the largest, they are rugged, dependable, prime movers. built to take the hardest kinds of industrial, marine and field service.

Investigate Climax performance before you invest in any engine. Write for bulletins and catalog—Climax Engineering Company, Clinton, Iowa.

CLIMAX ENGINEERING COMPANY
General Offices: Clinton, Iowa
REGIONAL OFFICES
Chicago *Dallas* *Ft. Worth*
New York *Los Angeles*

HERE'S

CONDENSER CHLORINATION IN ACTION!



Charted above, is the performance, over a period of four months, of two identical condensers in a large midwestern power station. One was cleaned manually and the other kept slime free by chlorination.

Plug cleaning, *eight* times in four months, could not keep exhaust steam temperature within nine degrees of the manufacturer's guarantee. The chlorinated condenser, however, was never out of service for cleaning and kept exhaust temperature well below the guarantee with major savings in fuel and labor.

Write for further details on this installation and for data on the role of chlorination in your plant.

CD-18

WALLACE & TIERNAN PRODUCTS, INC.

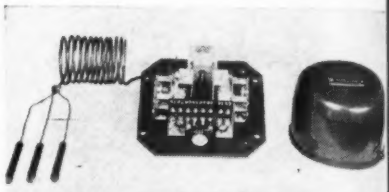
Manufacturers of Chlorine and Ammonia Control Apparatus

Belleville 9, New Jersey **Represented in Principal Cities**

shaft through a universal joint, it is claimed, give longer service and quieter operation.

Extra-heavy copper contacts give long life because contactor mechanism causes moving contact to roll and wipe on each operation, keeping it clean. Arcing is done on the tips, not on current-carrying areas, for lower maintenance. Contact tips are replaced easily. Removing just one screw on either the stationary or moving contact makes the contact tip immediately available for inspection.

Ample insulation is provided by wide pole spacing, plus barriers, and Bakelite high-dielectric bushings. Special anti-creepage shaft insulation and oil immersion of entire contactor, including coil, are for greater safety. Accessories available with new contactor are a built-in auxiliary switch with up to four normally open or closed poles and a permanent windless tank mechanism. *Allis-Chalmers Mfg Co, Milwaukee* 1, *Wis.*



Relay Equipment

WINDING-TEMPERATURE RELAY, which can be supplied on all new GE power transformers, operates from a combination of top oil temperature, ambient temperature and load current, and thus is said to enable winding hot-spot temperatures to be limited to values recommended by industry standards. Relay has three separate contacts which close in sequence as winding temperature increases.

On a transformer with cooling fans for supplementary rating, relay can perform following operations: (1) start cooling fans as soon as self-cooled load-carrying capacity of transformer is exceeded (2) give a warning signal as soon as overload has been on for the permissible length of time (3) sound an alarm or trip circuit breaker, taking transformer off circuit when overload exceeds specified limits.

The relay, which is mounted on outside of transformer tank at a convenient working height, can be checked easily in field without interrupting load on transformer. It is self compensating for ambient temperature, assuring correct maximum loading under all ambient conditions. *General Electric Co, Schenectady* 5, *N. Y.*

Elastic Sleeve Seal

AN ELASTIC SLEEVE, known as *The Seal of Approval*, is an all-round seal for centrifugal, rotary, reciprocating and other pumps with rotating shafts that must be sealed. It is at present manufactured for new compressors and as a replacement seal for old. It works equally well on bent, pitted or slotted shafts and eliminates all springs, shims and shaft glands because of perfected development of a new oil-resistant elastic material as the body of the elastic

Sales Engineering

In the Shaw organization, the Sales Department does not cease to function when a sale is closed. Our Sales Engineers personally follow through on each contract until it is completed to the customer's satisfaction. This engineered co-ordination is your assurance that your individual requirements will be met fully and dependably.

J. FREDERICK MERZ
Manager Sales Department

BENJAMIN F. SHAW Company

Known for Dependable Delivery and Quality
Pre-Fabrication—Piping Installation—Since 1893

Second and Lombard Streets
Wilmington 99, Delaware

PIPING DISTRIBUTORS • CONTRACTORS • FABRICATORS

HAVE YOU A HAIRLINE ADJUSTER ?

Another exclusive feature of the Certified Gauge is the Hairline Pointer Adjuster. You can now reset your pressure gauge pointer externally from the back of the case, without removing the glass or pointer. Very convenient when testing gauges on a test pump or dead weight tester.

A slight turn with a screw driver rotates the roller pinion of the Helicoid movement and adjusts the pointer to the desired dial reading. The Hairline Adjuster cannot be jarred out of position. Only Certified Gauges are made with the external Hairline Pointer Adjuster.

After serving in the Navy for several years, Certified Gauges are now available to industry for prompt delivery. Many of the largest companies in the country are already using them.

All Certified Gauges have the patented Helicoid Movement and are guaranteed accurate to within ½ of 1%. They stay accurate longer. Send for new catalog today.

ARMY NAVY

Certified GAUGE AND INSTRUMENT CORP.

34-18 Northern Boulevard Long Island City 1, New York

Certified GAUGE U.S.A.

sleeve. Sleeve seal bearing is at source of oil supply, thereby assuring longer life because of proper lubrication. Simplified design enables faster installation as there are fewer assembly parts and no fragile parts to break during assembly. *Temperature Control Devices, New Haven 15, Conn.*

Liquid Belt Dressing

NEW FORMULA GRAKO liquid belt dressing restores power-transmission capacity to transmission belts. This is accomplished without pitch, rosin or rosinous materials, petroleum byproducts, soap, acids, alkalies or other ingredients harmful to belting. All the oils contained in *Grako* are said to be nutritive to leather. New *Grako* pours readily at freezing temperature. It will not cake or "gum up" on pulleys and belts and is particularly suitable for conditions where steam and water are bothersome. All *Grako* labels will have the words "New Formula" overprinted on them in red ink. *Graton & Knight Co, Worcester 4, Mass.*

Platinum Thermocouple

IMPROVEMENTS in platinum thermocouple assemblies used with 2-hole silica blocks for glass tank crowns result, it is said, in longer service life for protecting tube assembly and facilitate removal of thermocouple assembly for periodic inspection. Major improvement consists of replacing with heat-resisting stainless steel the secondary protecting tube previously made of steel. The change, it is added, reduces oxidation to a minimum, eliminates tube freezing and permits its removal for inspection. *Brown Instrument Co, Philadelphia, Pa.*

Waterproof Coating

LIQUINOLEUM, a waterproof coating for roofs, walls and other surfaces exposed to the elements, is highly resistant to extremes of temperature. It is unaffected by acid fumes or effects of most chemicals. *Liquinoleum* does not crystallize on setting. Even flame from a blow torch, according to maker, will not cause it to catch fire, flow or run. It is applied to any surface with brush or trowel. *Continental Asbestos & Refining Corp, 1 Madison Ave, New York 10, N. Y.*

Cleaning Powder

TRI-SAN DEODORIZES, cleans and disinfects surfaces in one single operation. It is a mildly alkaline, free-flowing fine white powder, completely soluble in water, forming a clear, colorless, odorless solution. It contains no hypochlorites, iodine, caustics, phenolic or mercurial compounds, heavy metals, volatile solvents or corrosive ingredients. Add *Tri-San* to water, in recommended concentration, and stir for a moment to dissolve all ingredients before using. *Tri-San* is packaged in 300-lb barrels, 110-lb kegs and 45-lb pails, all net weight. *Oakite Products, Inc, 22 Thames St, New York 6, N. Y.*

Full production will need full power . . .

Wire ahead!

DO YOU KNOW how badly inadequate wiring can reduce the efficiency of advanced electrical equipment? From twenty-five to fifty per cent! Check your postwar plans now. Make sure wiring, service equipment, keep pace with your production hopes.

Wiring based on past standards won't do it. Wiring based on future power needs *will* do it. Certainly it will be a lot cheaper to change blueprints than face expensive alterations later.

Talk that over with your consulting or plant power engineer—your electrical contractor or power salesman. They'll confirm the logic of *foresighted* wiring in postwar plans. Anaconda Wire & Cable Company, Subsidiary of Anaconda Copper Mining Company. General Offices: 25 Broadway, New York City 4. Chicago Office: 20 North Wacker Drive 6. Sales Offices in Principal Cities. 45307

You pay for the whole piece of equipment—why let obsolete wiring run it at only part-way capacity?
DON'T BE PENNY-WISE AND POWER-FOOLISH
HELP BRING VICTORY SOONER . . . BUY MORE WAR BONDS
ANACONDA
ANACONDA WIRE & CABLE COMPANY

FULLER ROTARY COMPRESSORS
BUILT FOR CAPACITIES TO 1800 C.F.M. PRESSURES TO 125 LB. VACUUMS TO 29.90 IN. REFERRED TO 30 IN. BAROMETER
AND VACUUM PUMPS
"SPOT" YOUR COMPRESSORS
FULLER
FULLER COMPANY

Why — excessive floor space and heavy, costly foundations?

Fuller Rotary Compressors require very little floor space in relation to capacity, have no vibration, and consequently require comparatively light, inexpensive foundations.

The installation illustrated above—two Fuller Rotary Two-stage Compressors, with individual motors, capacity each 750 c.f.m. free air, compressing from atmosphere to 100-lb. gage, were placed on foundations which formerly supported two conventional type machines with a capacity of 250 c.f.m. each, 100-lb. pressure... THREE TIMES the capacity on the same foundations!

"Spot your compressors . . . have air when, where and as you need it."

Bulletin C-5 illustrates and describes these machines. It's yours for the asking.

FULLER COMPANY
CATASAUQUA, PENNSYLVANIA

Chicago 3 · 1144 Marquette Bldg.
San Francisco 4 · 421 Chancery Bldg.
Washington 5, D. C. · 618 Colorado Bldg.

No. 4 of a series

C-112

FULLER
PIONEERS OF HIGH-EFFICIENCY ROTARY COMPRESSORS

Power News

(*Continued from page* 130)

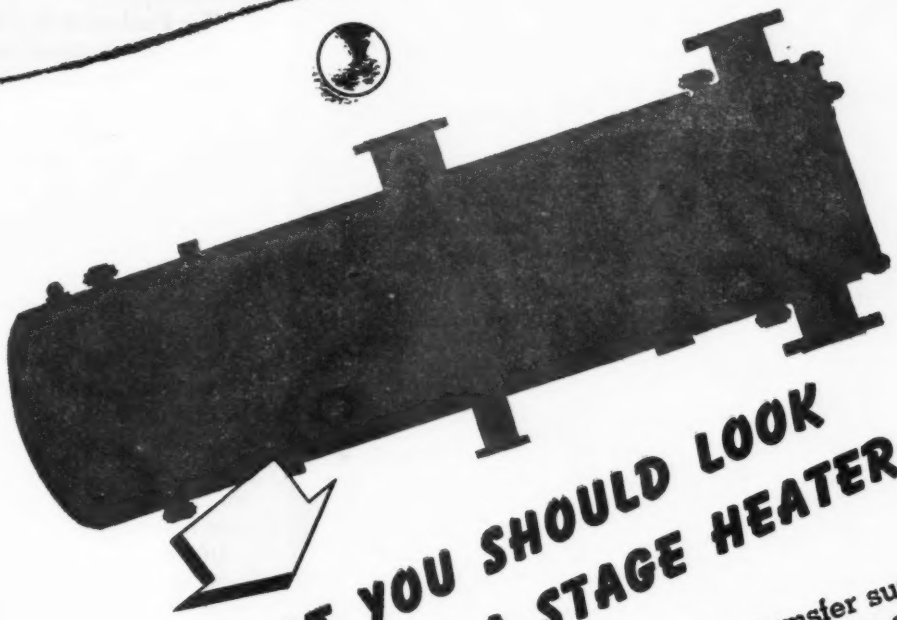
fans. This water put out the fires and put these four boilers out of service. The other boilers in the ship had to be shut down temporarily because the smoke and fumes were too severe to permit operating personnel to stay in the fire rooms.

When the four boilers were flooded, the brick in them averaged temperatures from 2800 to 3000 F; the superheater tubes were around 1000 to 1100 F and other tubes between 550 to 700 F. Despite the sudden inrush of cold water at these high temperatures, brick and pressure parts remained practically intact. All the engineers had to do was to drain the water from the boiler furnaces, clean them, and then two of them could be lighted off. They were not so fortunate with the other two boilers. A bomb had exploded on the hangar deck which completely damaged the uptakes on them. While the boilers were in the same condition as those which were relighted, the crippled uptakes made it impossible to put them back into service.

After the *Franklin* got under way, the engineers learned that some of the condensate drains had been damaged, permitting salt water to enter the boiler feedwater system. Two days after the boilers had been relighted, they tested the water in them for salt and found that the concentration in one boiler was as high as 128 grains per gal. However, the cyclone steam separators inside the boiler steam drums did their job well and the units were able to operate. Shortly afterwards, the engineers were able to get the salt content down.

After the attack Comdr Greene set up temporary engineering headquarters in the warrant officer's quarters where there was little damage. Telephone communications were established with the fire room, engine room and bridge.

Reprinted in convenient form from the Twelfth Annual Report of Engineers' Council for Professional Development, *Reading List for Junior Engineers* is a revision of original 1936 list. It covers natural science, philosophy, economics, sociology, psychology, business and industrial management, literature, history, biography, travel and the fine arts. Copies may be obtained for 10¢ each, or 5¢ each in lots of 50 or more, by addressing the Engineers' Council for Professional Development, 29 W 39th St, New York 18, N. Y. In Canada, direct inquiries to Engineering Institute of Canada, 2050 Mansfield St, Montreal 2.



WHAT YOU SHOULD LOOK FOR IN A STAGE HEATER

ONE OF A SERIES OF ADVERTISEMENTS DESCRIBING THE MANY TYPES OF G-R HEAT TRANSFER APPARATUS

In addition to the proper amount of heat transfer surface, a stage heater must have several features of design and construction to assure and maintain satisfactory operation and service.

Some of these features are:

Positive prevention of leakage at water heads.
Free expansion and contraction of tubes.
Ample support of tubes to prevent sagging and vibration.
Effective baffling of steam and air.
Utmost simplicity combined with sturdiness.
Convenience of access and ease of maintaining tightness of gasketed joints.

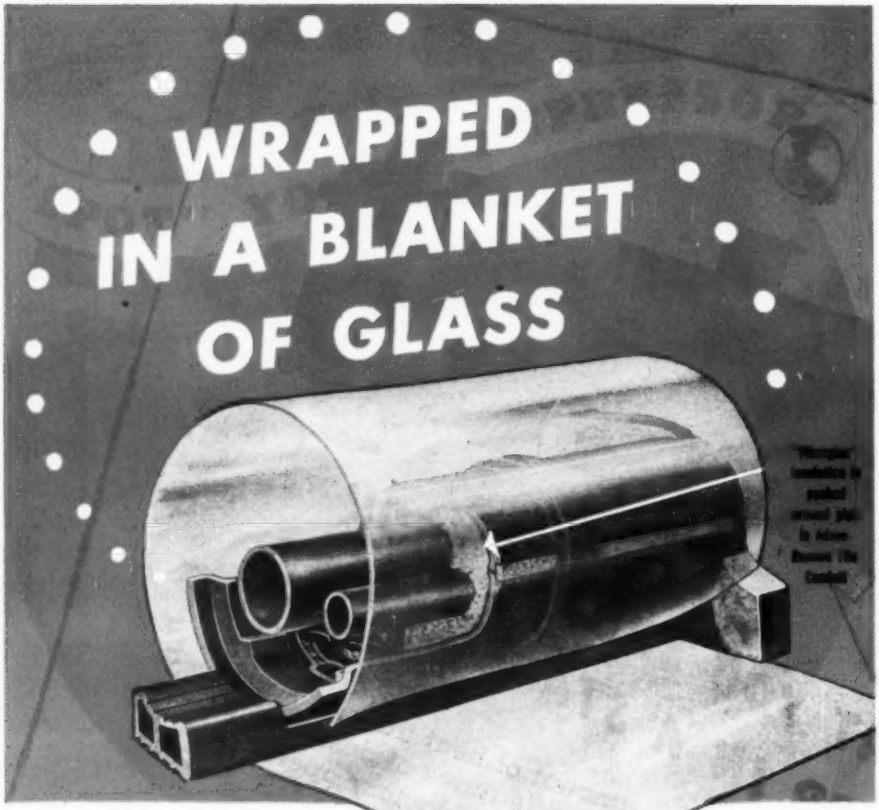
All these, and other advantageous features . . . many of them exclusive . . . are provided in the various types of G-R Stage Heaters for high, moderate and low pressures. Our Bulletin 277 describes these units in detail and explains how G-R Stage Heaters assure exceptional heating effectiveness, trouble-free service, and economical maintenance. Your copy of this informative bulletin will be sent on request.

G-R BUILDS ALL THESE UNITS FOR HEAT TRANSFER SERVICE . . .

Evaporators
Stage Heaters
Gas Coolers
Drain Coolers
Aftercoolers
Air Preheaters
Fuel Oil Heaters
Jacket Water Coolers
Process Heat Exchangers
Transformer Oil Coolers
Generator Air Coolers
Lubricating Oil Coolers
Storage Tank Oil Heaters

THE GRISCOM-RUSSELL CO.
285 Madison Ave., New York 17, N. Y.

GRISCOM-RUSSELL
Pioneers in Heat Transfer Apparatus



Steam Carried Long Distances with Minimum Heat Loss

For an efficient steam line installation, you will put the pipe underground where it is out of the way — give it the best protection against moisture that you can—insulate it to keep the heat in the line to the point of delivery.

That's just the combination you get when you run your steam lines in ADSCO-Bannon Tile Conduit. Made of vitrified clay tile, installed with ADSCO Filler Insulation (a "Fiberglas" Product) it can't be topped for permanency or thermal efficiency.

Furnished for several combinations of pipe in the same conduit. Split tile construction makes pipes readily accessible for threading or welding. Highly skilled labor not required.

Base drain carries away ground seepage water — keeps insulation dry — prevents undue heat loss. Write for quotation giving length of line and size of one or more pipes to be insulated and Bulletin No. 35-67PR.

AMERICAN DISTRICT STEAM COMPANY
N. TONAWANDA, N. Y.
MAKERS OF "UP-TO-DATE" STEAM LINE EQUIPMENT FOR OVER 65 YEARS

Write for Quotation On

ADSCO-BANNON
TILE CONDUIT
WITH ADSCO FILLER INSULATION
(A "Fiberglas" Product)

Liberated Allied Nations Get Equipment Priorities

War Production Board assigned AA-3 ratings to a program for 74,800 kw of steam and diesel generating equipment for countries served by the United Nations Relief and Rehabilitation Administration. This program is part of that referred to recently by President Truman, who asked war agencies to give all necessary equipment priorities to meet minimum civilian requirements of liberated allied nations.

In addition, 10,000 kw of packaged steam units are to be shipped to the Netherlands government for powering pumps to drain lands flooded by the retreating German army. This equipment is part of a $5,000,000 program which WPB rated high under the Truman request.

Of the UNRRA program, 50,000 kw is to be in steam units of 1000-kw and 2000-kw sizes. The diesel program includes 24 units of 600 kw each, being manufactured by Worthington Pump & Machinery Corp., at its Buffalo plant, and 26 units of 400 kw each, by Buckeye Machine Co, of Lima, Ohio. Cost of entire UNRRA program is set at $9,500,000.

Steam Unit Contracts

Contracts for the steam units, which will take eight to nine months to build, have not yet been let although bids have been taken and contracts are expected to be signed by the Treasury Dept's Procurement Div. Cost is expected to be under $100 per kw. Diesel portion of program is expected to be shipped in the fourth quarter and cost per kw of these units is between $90 and $100.

All plants are skid mounted, following closely the general design of power-generating equipment shipped earlier to the Russians. Most of the UNRRA capacity had been scheduled to go to the Balkans, but there is no final decision yet as to where it will go.

Steam units for UNRRA are coal fired and require nine to ten "packages" per complete unit. Included are 400-psi 750-F boilers, the boilers for the 1000-kw machines having an output of about 16,000 lb per hr. Connections to put the units in service are kept to a minimum. The units put out energy at 50 cycles, 3150 v, and carry sufficient transformer capacity to make the energy available at local distribution voltages. Coal-handling equipment, including spreader stokers, machinery for lifting coal to bunker and monorail

Pacemaker!

BULLDOG INDUSTRIAL TROL-E-DUCT

Moves the Power with the Load

When power is needed for portable tools, it's there — right overhead. And it moves right along with the job.

BullDog Industrial Trol-E-Duct saves you money — does away with expensive installations of fixed wiring and the dangers of long, trailing cables. Completely enclosed, it guards your workers against accidental contact with "live" parts.

This safety feature also makes it an ideal electric feeder for Cranes and Hoists.

Industrial Trol-E-Duct gives you a flexible system — sections can be added any time you want to expand or change your shop set-up. And the whole system can easily be moved anywhere in your plant. It is 100% salvable, too — nothing to scrap.

Single Phase or Three Phase, AC or DC — 575 Volts or Less.

For nearly half a century, we have been "pacemakers" in electrical distribution systems. We invite you to consult expert BullDog field engineers about the power problems in your plant. Or write us for descriptive folders.

BUY WAR BONDS

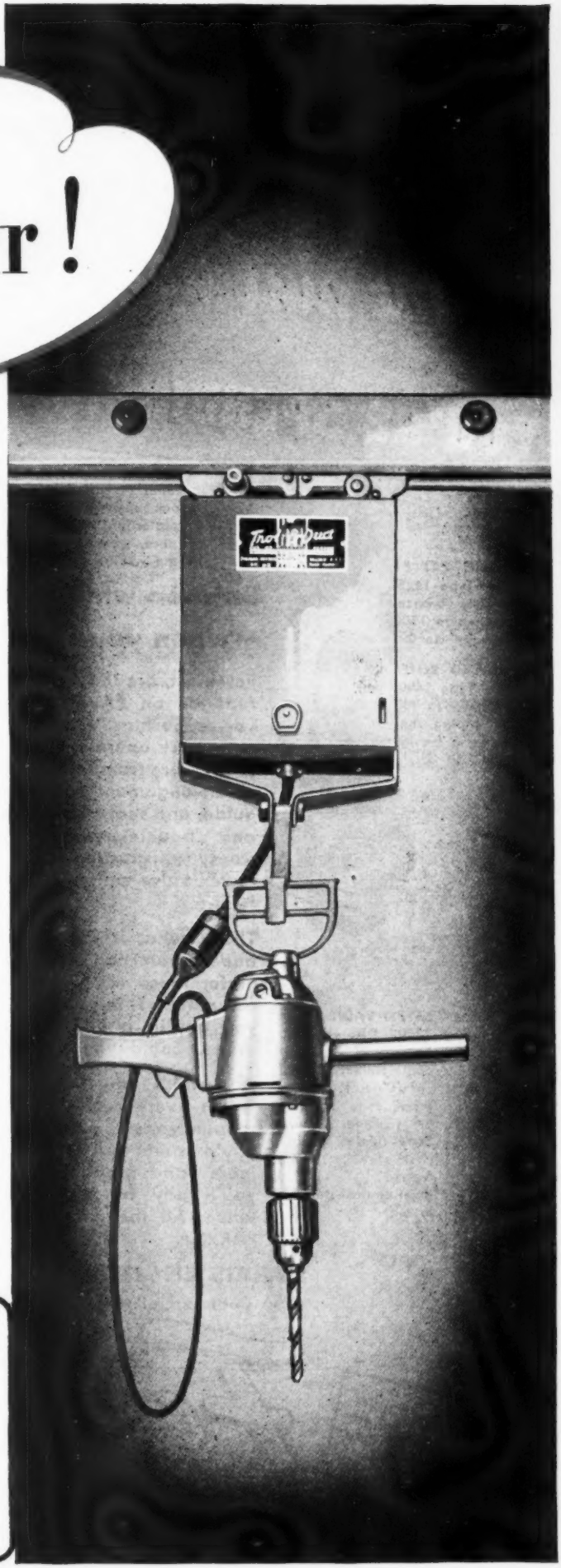
BULLDOG

ELECTRIC PRODUCTS COMPANY

Box 177, R. Pk. Annex
Detroit 32, Michigan

Field Engineering Offices in All Principal Cities.

Also Manufacturers of Vacu-Break Safety Switches — SafToFuse Panelboards—Switchboards—Circuit Master Breakers—BUStribution Duct, for "plug-in" power—Universal Trol-E-Duct, for flexible lighting.



WHEN YOU BUY A RELIEF OR SAFETY VALVE--

You pay a sizable sum for ANY relief or safety valve. So when you buy one, specify FARRIS—and get the *added* protection, the *maintenance-free* performance, and the *dependability* for which the FARRIS valve is noted.

HYDRAULIC RELIEF VALVE—Type 1425. Heavy duty bronze. Pressures up to 1500 lb. Sizes ½" to 2".

STANDARD RELIEF VALVE—Type 1400. Liquid service to 300 lb. Both piping connections in body. Sizes ½" to 2½"

Let's see what you get —when you specify FARRIS

Foremost, are the *improved engineering features* on FARRIS relief and safety valves. Such as "high-lift"—for accurate non-shock operation and minimum loss of pressure from relief action. And "precision alignment" of spring, stem, disc, guide, and seat—for precision operation and trouble-free performance. And sturdy construction—for long life. And fewer valve parts—for reduced risk of failure.

That's what it takes to give you the *added* protection and *maintenance-free* performance for which FARRIS valves are noted. That's what—WE PLEDGE—you get in a FARRIS relief or safety valve. Could you possibly buy more?

And that's why your FARRIS valve is worth every cent you pay for it . . . though we still admit, "that ain't hay" you're spending! But you'll find it's no more—and probably a lot less—than you'll pay for any other top-quality valve. All the more reason to specify *FARRIS!*

SAFETY VALVE—Type 2350. Disc guided. Economical first cost and maintenance. Full inlet port. Meets ASME code. Flanged or screwed outlets. Semi-steel 250 lb., cast steel 600 lb. Bronze ½" to 2". Steel or semi-steel 2" to 6".

FARRIS ENGINEERING COMPANY
366 Commercial Ave., Palisades Park, N. J.

Write today for Bulletin on our complete line of Relief and Safety Valves.

Farris
SAFETY and RELIEF VALVES

ash-removing equipment is included, as is water-treatment equipment.

Diesel equipment required considerable extra design work to make it fit the *Berne diagram*, or dimensions of railroad tunnels through which the equipment must pass to get into the interior of Europe. All parts of the diesel units are mounted on one skid, in one package, except the evaporative cooler, which had to be put on a second skid to allow the units to meet the requirements. These turbo-charged units are equipped with fuel-handling and water-cooling equipment and switchboards. They are 50-cycle machines, generating at 400/230 v and have distribution panels with sufficient wire to allow considerable leeway in placing them.

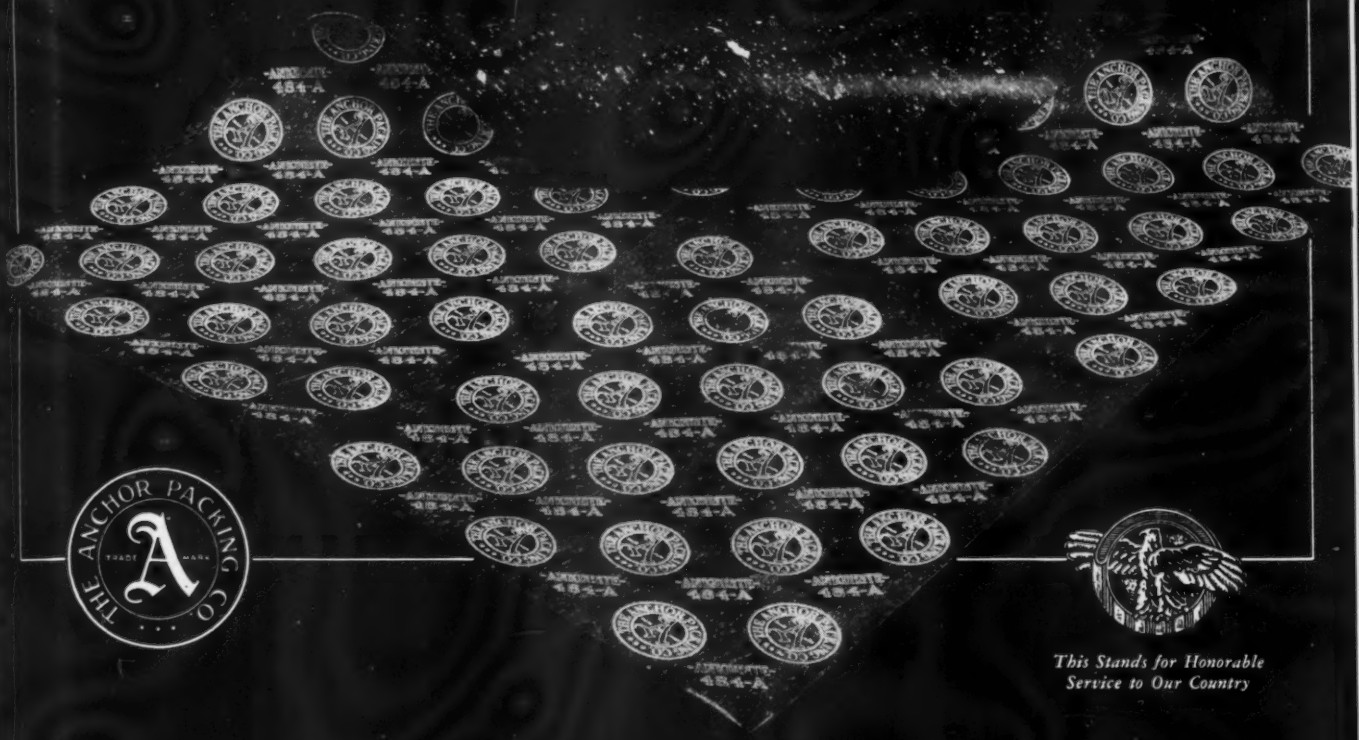
The 10,000 kw of steam for the Netherlands is paid for in cash. The equipment is essentially the same as the UNRRA steam capacity, but some changes have been made to meet Dutch standards. It is 50-cycle equipment generating at 6000 v and carries enough transformer capacity to distribute the energy at the standard Dutch distribution voltage, 11,000. In addition, the Dutch have purchased about 200 diesel-powered pumps, a number of which have been shipped.

It is rumored that the Netherlands Purchasing Commission, which recently cut off negotiations for three 7500-kw steam turbines, now surplus at the government's Lake Charles, La., magnesium plant, will go to Switzerland for the capacity they seek. Dutch officials told the Defense Plant Corp, which owns the Lake Charles machines, that they would require more equipment than was available at Lake Charles.

Army-Navy Contractors Guide for Prime and Subcontractors is an outline for war contractors which suggests methods of advance planning and gives practical procedures for settlement of terminated contracts. Copies may be obtained without charge by writing to Lt E P Lull, Readjustment Distribution Center, 6th Fl, 90 Church St, New York 7, N. Y.

The Order of Merit, highest honor conferred on its employes by Westinghouse Electric Corp, has been presented to George H Woodard, manager of the aviation gas-turbine div; Charles A Powel, manager of the headquarters engineering departments; James H Jewell, manager of industry sales departments; Robert D Blasier, an attorney in law department; Milton F Meissner, assistant to Vice-President Andrew H Phelps; H W Tenney, assistant to vice-president in charge of Pittsburgh divisions; and Charles A Scarlott, editor of the *Westinghouse Engineer*. The award carries with it a bronze plaque bearing a silver "W" and an engraved citation certificate.

ANKORITE No. 484-A COMPRESSED ASBESTOS SHEET PACKING SOLVES YOUR GASKET PROBLEMS



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Ankorite No. 484-A Sheet Packing is manufactured from the finest materials, employing a new synthetic bonding compound. This sheet can be standardized for high and low pressures, with a wide degree of temperature ranges.

Conforms to and meets U.S.N. Specification 33-P-13-C

Furnished in a wide variety of widths and thicknesses.

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...uston 2, Texas	509 Washington Avenue
...nsas City 6, Missouri	1332 Oak Street
...Angeles 21, California	720 Mateo Street
Montreal 20, Canada	5575 Cote Saint Paul Road
Milwaukee 2, Wisconsin	903 East Kilbourn Avenue
New Orleans 4, Louisiana	418 Common Street
New York 13, New York	100 Sixth Avenue, near Canal
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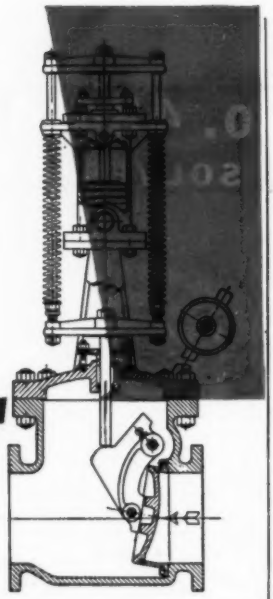
- Tight Closure
- Positive Action
- No Sticking
- Every Installation Requirement

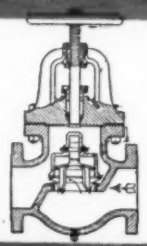


DAVIS
non-return valves

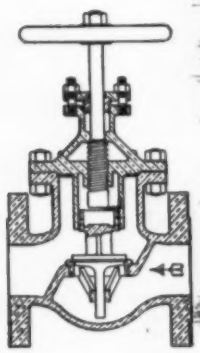
Davis Non-Return Valves are built in models to suit every installation requirement. They are of simple construction, with long-life working parts. Features include: absolutely tight closure, positive action, and no sticking due to expansion caused by temperature changes, or due to foreign matter, such as dirt, scale or sludge. Flow resistance and pressure drop are minimized and valve action is *immediate* if flow is reversed. Outside counterweight gives visible action, and affords a ready means of hand testing.

Send for Bulletin 101A for complete information on Davis Back Pressure, Exhaust Relief, Stop and Check, Non-Return and Relief Valves.

Davis straight flow type turbine bleeder non-return valve for turbine protection in the event of oil system failure, overspeed, or reverse flow. Quick, sensitive action, and "hammer blow" closure.

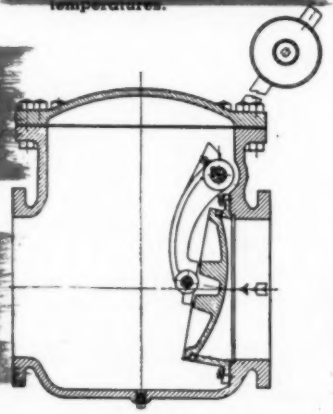


Davis No. 185 stop and check valve. Internal dash pot and through bolted bonnet. Semi-steel body, for 250 p.s.i. and 400° F. steel temperature or steel body for higher pressures and temperatures.



Right: Davis No. 184 Balanced Check Valve, counterbalanced straight flow type.

Left: Davis No. 185 Screwdown Check Valve. Through bolted bonnet, bronze body, and renewable seat. Can be closed right to a stop valve.



2540 S. Washtenaw Avenue, Chicago 8, Illinois

DAVIS REGULATOR COMPANY

Holland Rebuilds Power Capacity

Most of Holland's power stations have been recovered in usable condition, now that the Germans are out of control, but much repair work will be needed to restore them to full capacity. Theodoor P Tromp, Minister of Public Works, Eindhoven, Holland, recently made this information public. His remarks were reported by the official Netherlands and Netherlands Indies News Agency.

According to Mr Tromp, the big power station at Geertruidenberg in North Brabant Province, rated at 135,000 kw before the German occupation, was found to have a capacity of only 35,000 kw when it was taken over from the Germans. To restore this station to its prewar capacity and to boost its output temporarily before permanent equipment can be installed, eleven large generators have been ordered abroad. These have a total capacity of 142,000 kw but several of the smaller ones will be used only on a temporary basis.

Of these, two generators, each with a capacity of 40,000 kw, have been ordered in Switzerland. Two of 2000 kw each are being shipped from the U. S. and two of 1000 kw each were expected last June. One generator of 20,000-kw capacity has been ordered from Switzerland, along with two others of 15,000 kw each. From Holland itself will come a 3000-kw unit, while England will be called upon for a 3000-kw machine for delivery this fall.

Important connections have been repaired in North Brabant Province so that electric power may be supplied to the northern portion of the Netherlands over that circuit from Antwerp, Limburg Province and Nijmegen as soon as the connection across the big rivers can be established. However, the high-tension mast at Bergsche Maas, to carry a high-voltage line across the river, which divides northern and southern Holland, must be rebuilt before the upper portion of the country can be connected with this circuit. Then the entire province of South Holland will receive electric current on a substantial basis.

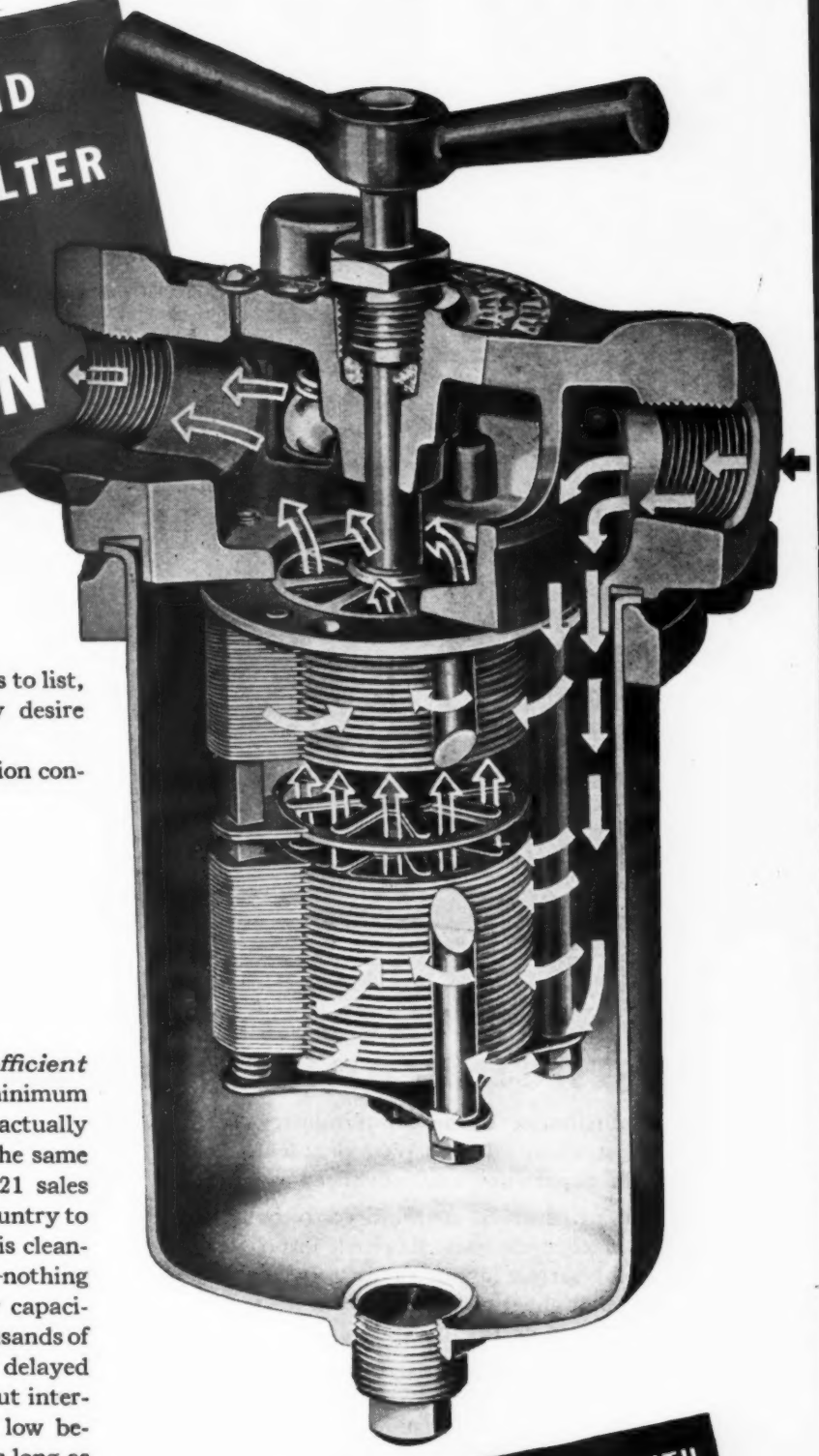
Mr Tromp reported that Supreme Headquarters has supplied a floating power station now located in Antwerp Harbor. It is feeding one portion of the southern Netherlands through the Merxem Power Station near the Dutch-Belgian frontier now.

The Minister emphasized that the power stations in Holland were recovered virtually intact, although the Germans had removed many important parts. However, since the government was informed of their removal in ample time, spare parts were ordered and are expected to arrive soon.

The coal situation is one of the most serious facing Holland. Temporarily, the southern part will have to provide current for recently liberated northern areas.

George Rahmann & Co held a dinner at Hotel McAlpin, New York City, to celebrate the completion of its fiftieth year in business. This company was established by the late George Rahmann. Upon his death in 1920, its control passed directly to his son, Arthur H Rahmann, now president.

WHAT YOU'VE SAID YOU WANT IN A FILTER YOU GET IN AN AUTO-KLEAN



WE asked a large number of manufacturers to list, in order of importance, the features they desire most in a fluid-cleaning device.

Here's what the men in charge of production considered most important:

1. Efficiency
2. Simplicity and compactness
3. Service from supplier
4. Ease of maintenance
5. Capacity
6. Continuous operation
7. Maintenance cost

Now consider the Cuno Auto-Klean. (1) It's *efficient*—positively stops all solids larger than minimum size specified. (2) It's simple and *compact*—actually smaller in size than other filters handling the same volume at equal porosity. (3) There are 21 sales engineering organizations throughout the country to provide service. (4) It's easy to maintain—is cleanable just by turning a handle, or by motor—nothing to replace or remove for cleaning. (5) Flow capacities range from a fraction of a gallon to thousands of gallons per minute. (6) Production is never delayed—the filter is continuously cleanable without interfering with flow. (7) Maintenance cost is low because the all-metal filter element will last as long as the equipment on which it is installed.

Cuno Auto-Klean—an all-metal, non-collapsible filter—is being used successfully on a variety of applications . . . from high-pressure to gravity-feed systems . . . from straining river water to filtering heaviest fuel oil.

You'll find filter selection information and specifications on the Cuno Auto-Klean in SWEET'S—or write us for Mechanical and Process Industries Catalog, Cuno Engineering Corporation, 224 South Vine Street, Meriden, Connecticut.

KEEP FLOW ON "GO" WITH

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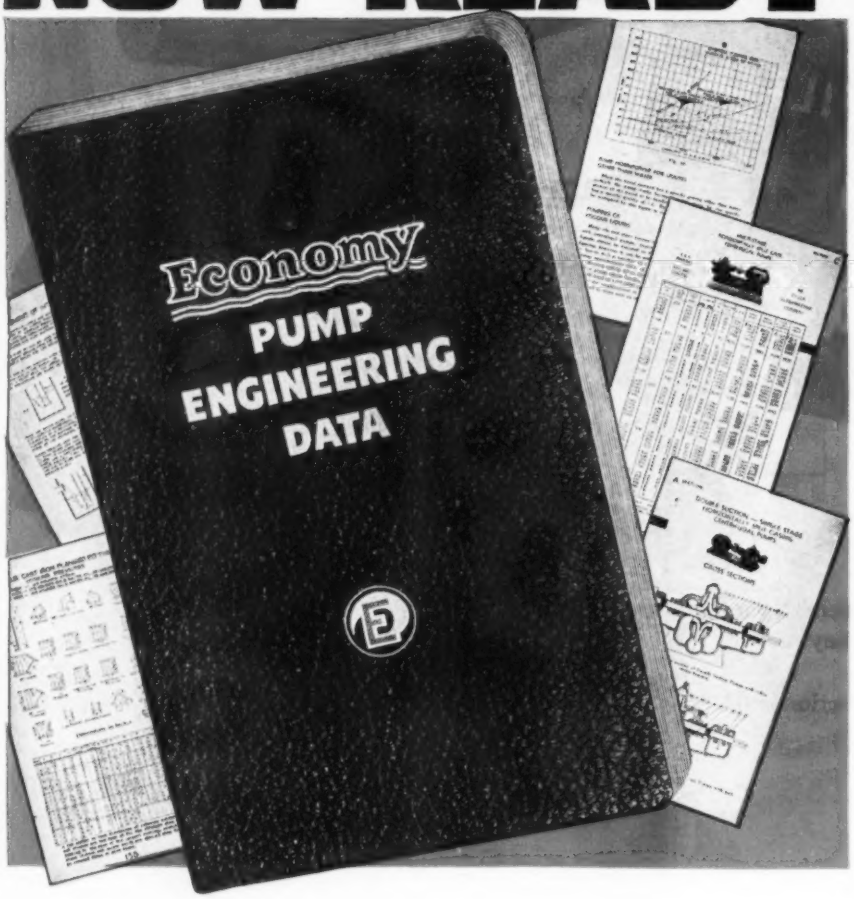
THE "FILTER-FINE" STRAINER

NOW READY



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A timely contribution to the pump industry—416 pages of factual data just when vital postwar problems require authentic facts, sound experience and advanced engineering practice.

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FOR OVER THIRTY YEARS MAKING BETTER PUMPS DO MORE

Gardner Appointed Chief Of New Mining Division

An oil-shale mining division has been established in the Office of Synthetic Liquid Fuels. E D Gardner, former regional engineer in charge of the bureau's Central Experiment Station at Rolla, Mo., has been appointed chief of the new division. Charged with responsibility for all mining activities of the synthetic liquid fuels program, the new unit will make engineering and economic studies to develop efficient, low-cost methods of mining the oil shale and possibly the coal to be used in producing synthetic gasoline and oil.

At the $1,500,000 oil-shale demonstration plant to be built at Rifle, Colo., Gardner and his staff will direct the development of a 200-ton-a-day shale mine, which can be enlarged if necessary, and supervise the installation and operation of a 1½-mile aerial tramway to carry the shale from the mine to the retorting plant. Oil-shale mining research will be conducted at the oil-shale research and development laboratory being built at Laramie, Wyo.

OWU Relaxes Control Of Shipping Schedules

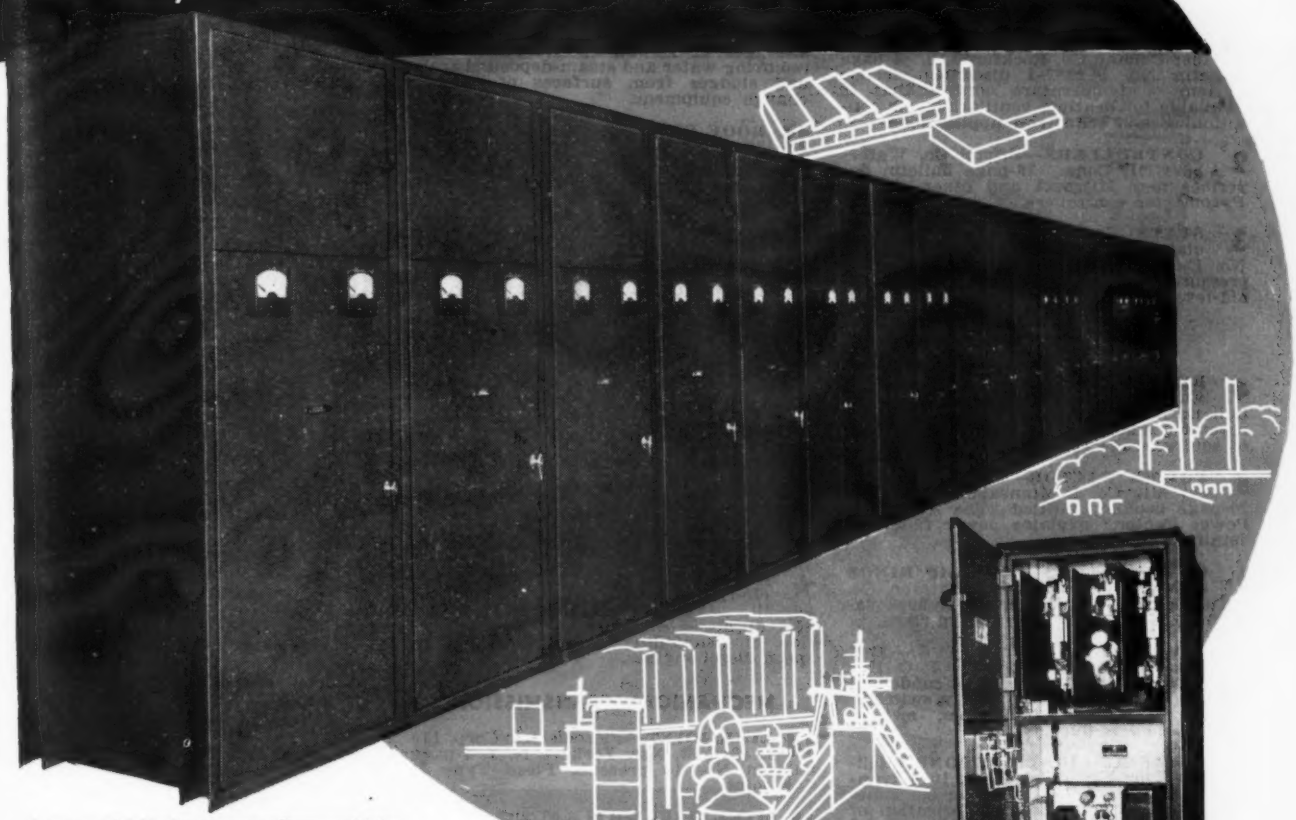
Another step in the Office of War Utilities *decontrol* policy was taken recently when it removed six items completely from scheduling controls of order M-293 and reclassified all but three other electrical items so as to eliminate the requirement of monthly reports on shipping schedules. In addition, OWU amended Schedule IV of order L-154 to remove from specifications control all power switchgear except metal-clad switchgear and oil circuit breakers.

Removed completely from Table 8 of M-293 were generators with steam turbines, hydro turbines and those powered by diesel engines, soot blowers, single-phase domestic watthour meters of 25 amp, 240 v or less capacity, and integrating electric meters and other watthour meters.

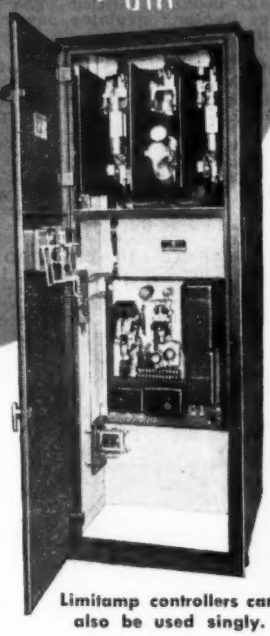
All other items in Table 8 were moved from the X or XY scheduling classes to the undesignated class except oil circuit breakers of 220 v capacity or more, air circuit breakers except AB or ET types, metalclad switchgear containing oil or air circuit breakers, and power switchboards. In the undesignated class, monthly reports on shipments will not be required, although the War Production Board will be able to designate shipments of any undesignated class items by directive if it chooses to do so. The three classes in which no change was made remain on the X procedure, whereby monthly reports of planned shipments are required, subject to change by War Production Board, and are frozen once submitted.

The change to undesignated will affect new orders, but will not retroactively unfreeze existing shipping schedules. Likewise, existing shipping schedules for those items removed completely from Table 8 will remain valid. While manufacturers of undesignated products can schedule shipments to suit themselves, it must be done in conformity with priority ratings.

2300-VOLT PACKAGED CONTROL FOR SURE, SHORT-CIRCUIT PROTECTION



A group of 4 Limitamp controllers—cubicle-type construction makes for easy installation and attractive appearance, and yet takes a small amount of floor space.



Limitamp controllers can also be used singly.

Factory-assembled Control Offers You 3 Important Savings

1. *Simplifies Purchasing and Layouts*—When you specify G-E Limitamp control, you save hours for your engineers, buyers, and draftsmen—our engineers have assumed full responsibility for selecting and assembling the correct control components for you.

2. *Saves Installation Time and Space*—Instead of many separate devices, you install only one control board. You just have to put the preassembled group control in place and connect the incoming and outgoing motor leads, and it's all set to go to work.

3. *Saves Critical Materials*—These starters help you save the vital materials that would otherwise be used for buses, conduit fittings, and wire connections.

½-cycle Operation Means Safety

Limitamp control will stop high-voltage fault currents in one-quarter cycle, and clear them in less than one-half cycle—reducing the effect of the short circuit on your motor or control.

Other Advantages, Too

Bulletin GEA-4247 will tell you all about them—how Limitamp control affords safety for men and machines, how it can be furnished as single units, and how it comes in different enclosures for different operating conditions. For a copy, contact your local G-E office or write directly to General Electric Co., Schenectady 5, N. Y.

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CONTROLS, MECHANICAL

1 TEMPERATURE CONTROL — Barber-Colman Co, Rockford, Ill. 4-page bulletin No. F-2287-1 discusses electric system of temperature control that is available for heating, ventilating, air conditioning and industrial applications.

2 CONTROLLERS—Bristol Co, Waterbury 91, Conn. 16-page bulletin describes new Microact and other electric Pyromaster controllers.

3 STATS—Defender Instrument & Regulator Co, St. Louis 2, Mo. Bulletins No. E-3 and E-4 show a complete line of pressure, vacuum, temperature, float, liquid-level and feedwater regulator stats.

ELECTRICAL EQUIPMENT

4 REVERSING STARTERS — General Electric Co, Schenectady, N. Y. 4-page bulletin No. GEA-4368 covers ac magnetic reversing starters for full-voltage starting of squirrel-cage induction motors.

5 POWER FACTOR—Electric Machinery Mfg Co, E Minneapolis 13, Minn. 20-page booklet, entitled "The A B C of Power Factor," explains power factor in detail.

6 COMMUTATORS AND SLIP RINGS —Toledo Standard Commutator Co, Toledo, Ohio. Catalog lists over 3000 variations of commutators and slip rings.

7 ELECTRICAL APPARATUS — Bull Dog Electric Products Co, P O Box 177, Detroit 32, Mich. 86-page condensed catalog No. 451 discusses safety switches, light and power panelboards, switchboards and bus duct systems.

8 GREASING INSTRUCTIONS—Reliance Electric & Engrg Co, 1076 Ivanhoe Rd, Cleveland 10, Ohio. 4-page bulletin No. 3042 covers grease lubrication of antifriction bearings in Reliance ac and dc motors, V*S drives and M-G sets.

MAINTENANCE MATERIALS

9 INDUSTRIAL PACKINGS — Greene, Tweed & Co, Bronx Blvd at 238th St, New York 66, N. Y. 8-page pocket-size bulletin No. P-3 serves as a guide to selecting the most suitable packing for specific fluids, equipment and types of service.

10 CHEMICAL SCALE REMOVAL—Dowell, Inc, 524 Kennedy Bldg, Tulsa 3, Okla. 20-page booklet sets forth advantages of Dowell chemical method of removing water and steam-deposited scales and sludges from surfaces of heat-exchange equipment.

11 ROOF COATING—A C Horn Co, 43-36 10th St, Long Island City 1, N. Y. 4-page booklet presents Hornlume, a material which contains asphalt and aluminum for roof protection.

12 HYDRAULIC PACKING — Weatherhead Co, 300 E 131st St, Cleveland, Ohio. 8-page booklet describes construction, operation, installation and application of Weatherhead T-ring packing.

13 CLEANING MATERIAL — Oakite Products, Inc, 22 Thames St, New York 6, N. Y. 20-page booklet presents Tri-San, a new chemical development having deodorizing, cleaning and germicidal properties.

All literature designated with a star (★) may be obtained only by writing direct to the manufacturer on company letterhead, giving writer's name and title.

★ **LUBRICATION** — Standard Oil Co (Ind), 910 S Michigan Ave, Chicago 80, Ill. 42-page technical bulletin No. 45-1 discusses Stanolube HD for lubrication of heavy-duty gasoline and high-speed diesel engines.

MECHANICAL TRANSMISSION

14 LINK JOINT—Piezoelectric Corp, 110 E 42nd St, New York 17, N. Y. 4-page bulletin No. 45 presents Piezo Type H link joint.

15 WIRE ROPE—R G LeTourneau, Inc, Peoria, Ill. New wall chart gives cable requirements for all LeTourneau equipment. It stresses the service angle and gives practical tips on how to get longer service from wire rope.

16 BALL BEARINGS — Advertising Dept, New Departure Div, General Motors Corp, Bristol, Conn. 24-page booklet No. BA, entitled "Bearing Application," covers fundamentals of ball bearings.

17 GEARS—Dept NR, Foote Bros Gear & Machine Corp, 5225 S Western Blvd, Chicago 9, Ill. 66-page bulletin No. AQA gives performance curves, design details, operating speeds and other data on AQ gears.

18 MAGNETIC PULLEYS—Dings Magnetic Separator Co, 509 E Smith St, Milwaukee, Wis. 32-page catalog describes electromagnetic pulleys, pulley separators and other classes of magnetic equipment.

PRIME MOVERS AND ACCESSORIES

19 JET CONDENSERS — Worthington Pump & Machinery Corp, Harrison, N. J. 4-page bulletin No. W-204-B10 discusses low-level jet condensers, mounted on horizontal, single, wet vacuum pumps, for steam engine, small turbine or process applications.

20 AIR CLEANERS—Vortox Co, Detroit, Mich. Catalogs No. F-1295 and F-1297 cover Types G, GA, S and SA air cleaners.

21 SUPERCHARGERS — Superchargers, Inc, Milwaukee, Wis. 20-page booklet discusses supercharging and the internal combustion engine.

PUMPS

22 CENTRIFUGAL PUMPS — Yeomans Bros Co, 1433 N Dayton St, Chicago 22, Ill. 4-page bulletin No. 1011 presents Type SHB horizontal centrifugal pumps.

(*Continued on page* 188)

HOW TO ORDER

Be sure to fill out, completely one coupon for each piece of literature you order. (See sample below.) This gives your request authority and helps the manufacturer to address your copy completely. Readers who fail to prepare request blanks correctly may be disappointed under difficult postal conditions and limited quantities of bulletins available today.

Use as many coupons as you need, but cut them out and send them as one block in an envelope addressed to POWER, 330 W. 42nd St., New York 18, N. Y. Only requests made on these coupons will be honored.

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FOR GAS CLEANING, smoke abatement and removal of dust, fume, tar and other suspended matter from gas, there has been one universally accepted process for more than thirty years. In answer to your special problem, a Cottrell installation incorporating this rich experience in research, development and worldwide operation means the complete fulfillment of your requirements.

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Back waterwall and slag screen tubes, B & W Sterling type boiler

after seven years... no oxygen corrosion, thanks to Santosite

This is typical of boiler performance where boiler feed water is treated the simple Santosite* way: 30 parts of Santosite to one million parts of boiler feed water, maintained at all times. One simple test at regular intervals provides an accurate check.

Santosite (anhydrous sodium sulfite), eliminates oxygen in boiler feed water by combining with it to form sodium sulfate (Na_2SO_4). Since sodium sulfate and Santosite are both water soluble, neither can form objectionable sludge.

If you are interested in eliminating oxygen corrosion from your boiler system . . . if you want fewer shutdowns, less repairs, greater over-all boiler efficiency, write for complete details on Santosite now. Address: MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, 1700 South Second St., St. Louis 4, Missouri. District Offices: New York, Chicago, Boston, Detroit, Charlotte, Birmingham, Los Angeles, San Francisco, Seattle, Montreal, Toronto.

**Reg. U. S. Pat. Off.*

MONSANTO CHEMICALS
SERVING INDUSTRY...WHICH SERVES MANKIND

New Bulletins

(*Continued from page 186*)

23 ROTARY PUMPS — Worthington Pump & Machinery Corp, Harrison, N. J. 4-page bulletin No. W-487-B11 covers steam-jacketed rotary pumps for melted materials or highly viscous liquids requiring preheating.

24 CENTRIFUGAL PUMPS — Deming Co, Salem, Ohio. 20-page booklet, entitled "Facts You Should Know About Centrifugal Pumps and Impellers," contains basic information about various standard centrifugal pumps.

25 PLUNGER PUMPS — Warren Steam Pump Co, Warren, Mass. 4-page bulletin No. 239 gives features, sizes, capacities and specifications of Warren horizontal, duplex, plunger pumps.

OTHER EQUIPMENT

26 REFRIGERATION UNITS — Worthington Pump & Machinery Corp, Harrison, N. J. Data sheets No. C1100-S46, -S49, -S50, -S53, -S55, -S57, -S59, -S60 and -S61 cover Worthington Freon-12 refrigeration units.

27 RADIANT HEATING—A M Byers Co, Pittsburgh 22, Pa. 52-page bulletin gives principles and methods of calculation, engineering data in graphic and tabular form, coil layouts, installation methods with different types of construction and answers to most commonly asked questions on radiant heating.

28 FURNACE OBSERVATION DOOR—Bigelow-Liptak Corp, 2842 W Grand Blvd, Detroit 2, Mich. 4-page booklet presents features of new Type A observation door for furnaces.

29 HEATING BOILERS—Titusville Iron Works Co, Titusville, Pa. 8-page bulletin No. B-3000 discusses latest developments in compact, low-pressure boilers.

30 COMPRESSOR PERFORMANCE—Clark Bros Co, Olean, N. Y. 16-page booklet contains an article, "The Effect of Supercompressibility of Natural Gas Upon Compressor Performance," by Robert S Ridgway, which covers subject thoroughly.

31 STEAM-JET THERMOCOMPRESSORS—Worthington Pump & Machinery Corp, Harrison, N. J. 8-page leaflet No. RP-269 presents an article, entitled "Steam-Jet Thermocompressors Supply Intermediate-Pressure Processes," by Philip Freneau, that was reprinted from POWER.

32 INDUSTRIAL INSULATIONS—Baldwin-Hill Co, 544 Klagg Ave, Trenton 2, N. J. 28-page catalog describes various mineral wool insulations.

33 SPRAY GUNS—B F Goodrich Co, Akron, Ohio. 22-page booklet discusses Lonn rubber blow and spray guns and water savers.

34 LATHES—South Bend Lathe Works, 373 E Madison St, South Bend 22, Ind. 36-page catalog No. 9-G describes lathe line.

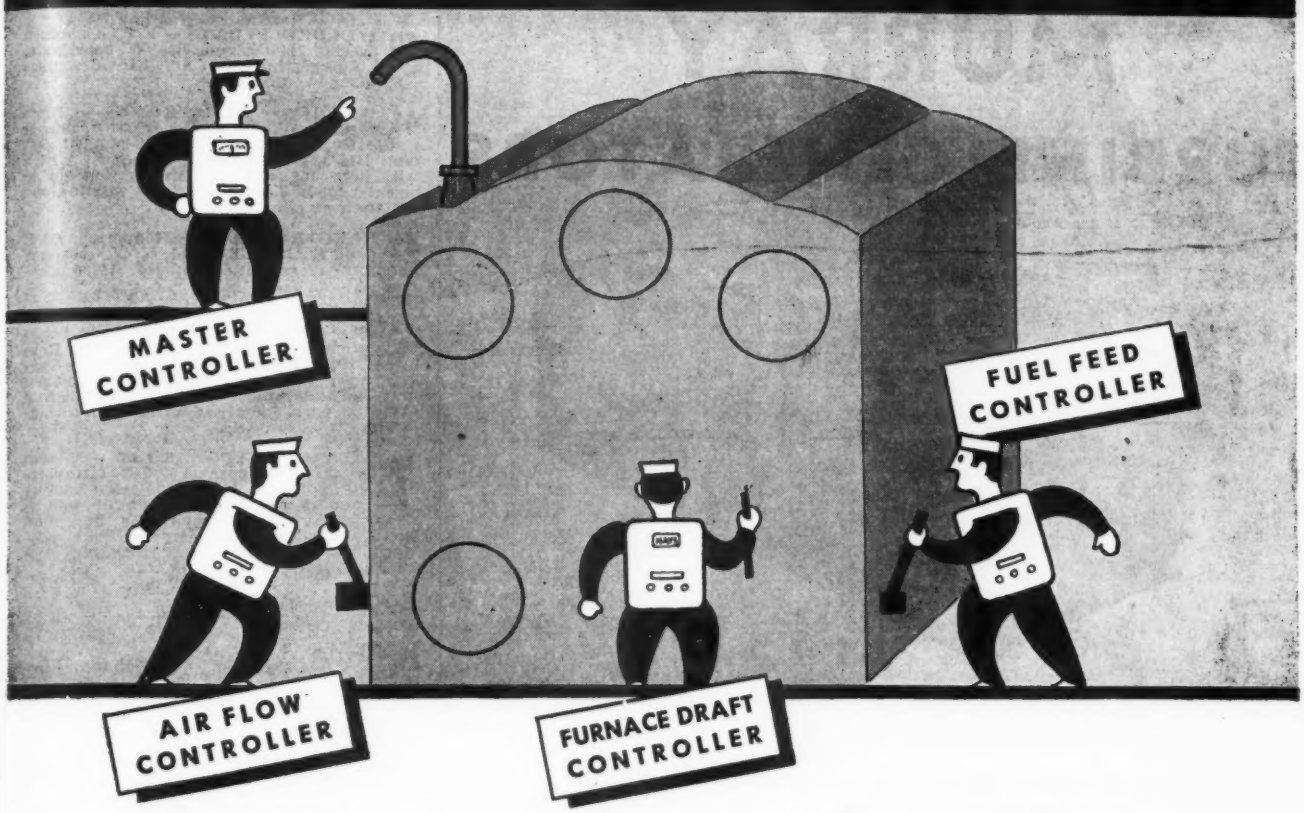
35 COAL SLICER HOIST—Silent Hoist & Crane Co, Brooklyn 20, N. Y. 4-page bulletin No. 53 presents new coal slicer hoist that solves frozen coal problem.

36 COAL STORAGE—Tractor Div, Allis-Chalmers Mfg Co, Milwaukee, Wis. 8-page booklet gives advantages of the tractor, scraper and bulldozer for storing and handling coal.

37 INDICATING INSTRUMENTS—Marion Electrical Instrument Co, Manchester, N. H. 12-page pamphlet explains history, uses and advantages of Marion glass-to-metal hermetically sealed electrical indicating instruments.

38 TACHOMETERS — General Electric Co, Schenectady, N. Y. 12-page bulletin No. GEA-4324 describes tachometers, each consisting of a generator and an instrument, that measure rotational speeds from 1 to 60,000 rpm and linear speeds that can be measured in terms of rpm.

ELECTRICAL OPERATION IS AS MODERN AS POST WAR INDUSTRY MUST BE!



How HAYS Combustion Control

measures, coordinates, acts . . . AUTOMATICALLY

You See the 12 Vital Facts of MODERN COMBUSTION CONTROL in HAYS SALES VISUAL

The most comprehensive, most understandable explanation of automatic combustion control ever compiled. Ask the Hays representative to show it to you.

1. The purpose of Combustion Control.
2. How that Purpose is accomplished—3 methods of control.
3. What results can be expected of each.
4. Elements of a *good* control system.
5. Elements of a good controller.
6. *Coordinating* the controllers.
7. Selecting the best system for your needs.
8. How Automatic Combustion Control operates.
9. How each individual controller operates.
10. How controllers are calibrated and adjusted to fit requirements.
11. How controllers are stabilized to prevent hunting or over-travel.
12. Typical installations of Automatic Combustion Control.

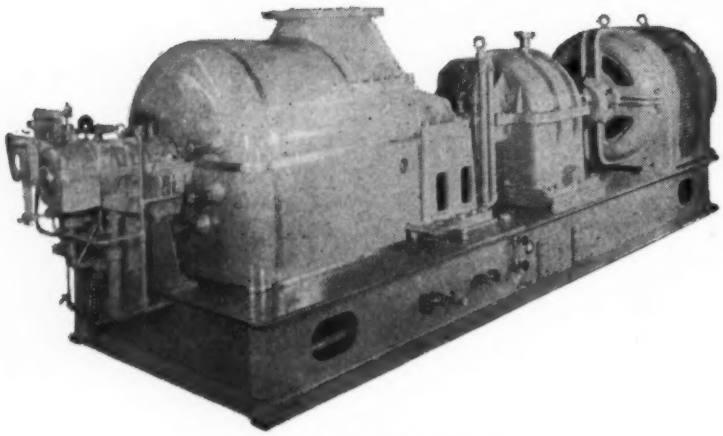
IT'S LIKE HAVING a smart, tireless four-man crew on the job—the boss (Master Pressure Controller) who waits for the call from the plant for more steam, then calls on the others to give him the necessary cooperation; the two men who control the Air (Air Flow Controller) and Fuel (Fuel Feed Controller) respectively; and the man who keeps the furnace draft constant (Furnace Draft Controller).

To a central panel come reports of every fluctuation in every combustion factor, to be recorded and measured. Instantly accurate impulses go from the Master Controller to the Air and Fuel Controllers. These subordinate controls in turn transmit their impulses instantaneously to the damper or air control device and to the fuel feed device. Thus steam generation is ***kept in practically perfect balance constantly.***

You can see the many advantages—big savings in man-hours, important cuts in fuel bills, greatly reduced maintenance. A big help in relating those benefits to your business is the Hays Visual Presentation of Automatic Combustion Control. A Hays Engineer can show it to you—no obligation, of course. A note to us will arrange it.

The HAYS CORPORATION
SINCE 1907 COMBUSTION INSTRUMENTS AND CONTROL
MICHIGAN CITY, INDIANA, U.S.A.

MURRAY
TURBINE GENERATORS



500 KW—PACKAGE TYPE

The unit shown above was designed to deliver 500 KW 50 cycles alternating current on steam at 285# gauge, 700 degrees F., an exhausting condensing to 27 inches vacuum. Thirty identical units were furnished.

Equipment included trip and throttle valve, oil relay governor controlling single throttling inlet valve with hand valve control for partial load operation, all service connections above floor line except generator leads, drain piping brought to one point, and structural steel baseplate. The baseplate is sufficiently rigid so that the unit can be handled in one piece, and installed on the simplest of foundations.

While "Package Type" units are furnished for export for installation in remote areas not previously supplied with power, similar designs can be made for industrial plants for main or standby power supply.

MURRAY *also produces:*

Mechanical drive turbines, horizontal and vertical
Reduction Gears Steam Boilers

MURRAY IRON WORKS COMPANY
BURLINGTON, IOWA
Builders of Steam Power Equipment for Three Quarters of a Century

39 SAFETY VALVE—Associated Valve & Engrg Co, 510 N Dearborn St, Chicago 10, Ill. Single sheet bulletin No. LF545 presents Aveco No. 1000 Limit-Flow safety valve for high-pressure air hose.

40 WELDED FLOATS—W H Nicholson & Co, 12 Oregon St, Wilkes-Barre, Pa. 8-page bulletin No. 345 describes Nicholson welded floats.

41 WELDING ELECTRODES — Page Steel & Wire Div, American Chain & Cable Co, Monessen, Pa. 36-page digest No. DH-821 contains information which will help make it easier for buyers to select proper electrode or gas welding rod for their particular work.

42 ELECTRODES—Air Reduction, 60 E 42nd St, New York 17, N. Y. 56-page booklet covers entire line of Airco electrodes.

43 THEORY OF SOUND—Burgess-Manning Co, Chicago, Ill. 34-page booklet, entitled "A Story of Sound," by Robert R Buntaine, is written in simple language so that the phenomena of sound may be understood by those who are not familiar with scientific terms and formulas of acoustics.

44 SERVICE LABORATORY — Nilsson Electrical Laboratory, 103 Lafayette St, New York 13, N. Y. 20-page booklet shows some of the custom-built instruments and special apparatus manufactured as well as equipment and testing devices used in repair laboratory for electrical measuring instruments.

Charles A Powel, of Westinghouse Electric Corp and president of American Institute of Electrical Engineers, has been named chief of electrical and radio section of the U. S. Group Control Council for Germany. He will be on the staff of Gen Lucius D Clay, deputy to Gen Dwight D Eisenhower as U. S. representative on the council. Powel's first job will be to survey electrical and radio manufacturing plants in the U. S. zone of Germany and to establish controls under which they will be allowed to resume the production of civilian goods without war potentialities. Powel will also be expected to see that these industries are so reestablished as not to be able to revert to war manufacture.

To facilitate quick, easy reconversion inventories, the Allis-Chalmers Mfg Co announces that it will soon begin to distribute a reconversion inventory kit, covering centrifugal pumps, V-belt drives and electric motors. An extension of the company's wartime aid-to-maintenance program, the kit will enable the user to determine the exact condition of each piece of existing equipment that is scheduled for peacetime production duty. This kit contains a set of three fact sheets, one for each type of unit, with suggestions for inventory procedure, and a set of three check lists, which summarize the procedures and permit detailed appraisal of each unit. Write to the nearest Allis-Chalmers district office, or to Dept 561, Allis-Chalmers Mfg Co, Milwaukee 1, Wis., for free kit.

Negotiations have been completed for transfer of a 35,000-kw unit from the Lake Charles plant to Lake Catherine, Ark., where its output will be marketed by the Southwestern Power Administration. Dismantling the machine for shipment is being undertaken under direction of Sanderson and Porter. Title to the unit is expected to remain in Defense Plant Corp hands for some time.

Masoneilan No. 27 Regulators

Tops for Service . . . Cut Maintenance Man-Hours

Give Long-Lived Service

Out of actual on-the-job performance comes evidence of the ability of Masoneilan No. 27 Regulators to provide accurate, positive control of pressure. So precise is their control that they actually draw circles on recording instruments even under severe fluctuating demands. And best of all, they do so year after year without continual adjustment for load changes, without control time lag, without shift from control setting between full, open and closed. In addition to accurate performance, their ease of installation and rugged, fully-enclosed construction provides savings in operating and maintenance expense. Investigate Masoneilan No. 27 pressure regulators. They are available for controlled pressures between 5 and 1800 psi. Write for catalog 72, today.

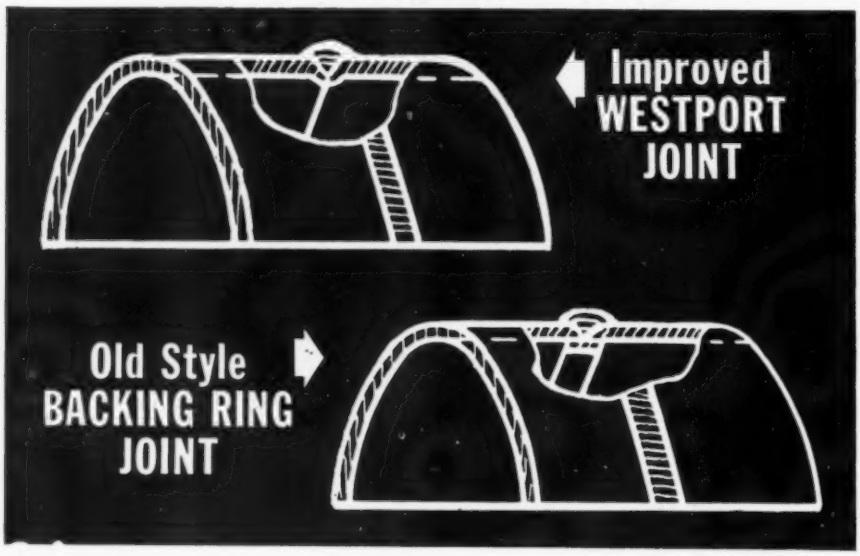
MASON-NEILAN REGULATOR CO.

1186 ADAMS ST., BOSTON 24, MASS., U.S.A.

New York Chicago St. Louis Philadelphia Houston
Pittsburgh Tulsa Los Angeles Cleveland Atlanta San Francisco
Mason Regulator Co. of Canada, Ltd., Montreal, Canada

MASONEILAN

YOU STRENGTHEN YOUR PIPING WITH THE RIGHT KIND OF WELDS . . .



THE RIGHT KIND OF WELD is the *sound* weld. And, because the Westport Patented Joint welding permits fusion buttwelded joints to be made from one side only, with complete penetration at the root of the weld, this new method is highly successful and popular.

Especially suitable is the welding of heavy wall piping for high pressure temperatures.

Westport Welded Joint Features:

(1) Greater flexibility in alignment of pipe, valves and fittings.

(2) Complete penetration at root of the weld.

(3) No construction in pipe area due to Backing Rings.

(4) No sacrifice in strength of the pipe due to removal of wall or Backing Ring.

(5) Smooth pipe contour at base of weld with no "icicles" or protrusions.

(6) Meets A.S.M.E. Standards.

ENGINEERS' NOTE:

DO YOU HAVE ANY PIPING PROBLEMS WE MIGHT BE ABLE TO HELP YOU SOLVE? All types of prefabricated piping jobs are today being done by W. K. Mitchell & Co. Years of piping research and experience has taught us the solution to piping troubles. If we can be of help, please call on us. Our Engineers are always at your service.

Write for Bulletin and Descriptive Data

W. K. MITCHELL & CO., INC.
PHILADELPHIA 46, PENNA.

1899 M 1945

Army's Floating Plant Meets Power Shortage

Floating power plants, capable of supplying a small city with electricity, are one of the war-born developments of the Corps of Engineers. The idea was conceived after a battleship had hooked up to the power lines of a large northern city and supplied current in an emergency.

Latest and largest of these floating mobile plants is the *Inductance*, operated by the Memphis, Tenn., Engineer District, of which Colonel Garner W Miller is district engineer. The plant is housed in a steel hull, 318 ft long and 50 ft wide, and has a maximum draft of 14 ft. As it is a floating power plant, it can be moved to any point accessible to water transportation. Power is generated at 13,800 v by a 30,000-kw alternator driven by a 19-stage steam turbine. Steam is supplied to the turbine at 850 psi and 900 F by two marine express boilers equipped to burn oil or gas separately or simultaneously.

Two 300-kw diesel-driven generators aboard the plant are for emergency and starting-up purposes. A 3-phase power transformer, rated at 37,500 kva, raises generated voltage to a value suitable for transmission. Taps are provided so that voltages ranging from 63,100 to 138,000 may be obtained as required. Although rated at 30,000 kw, the plant can deliver 36,000 kw for an extended period. A total of 43 persons are required to keep the plant in operation 24 hr per day.

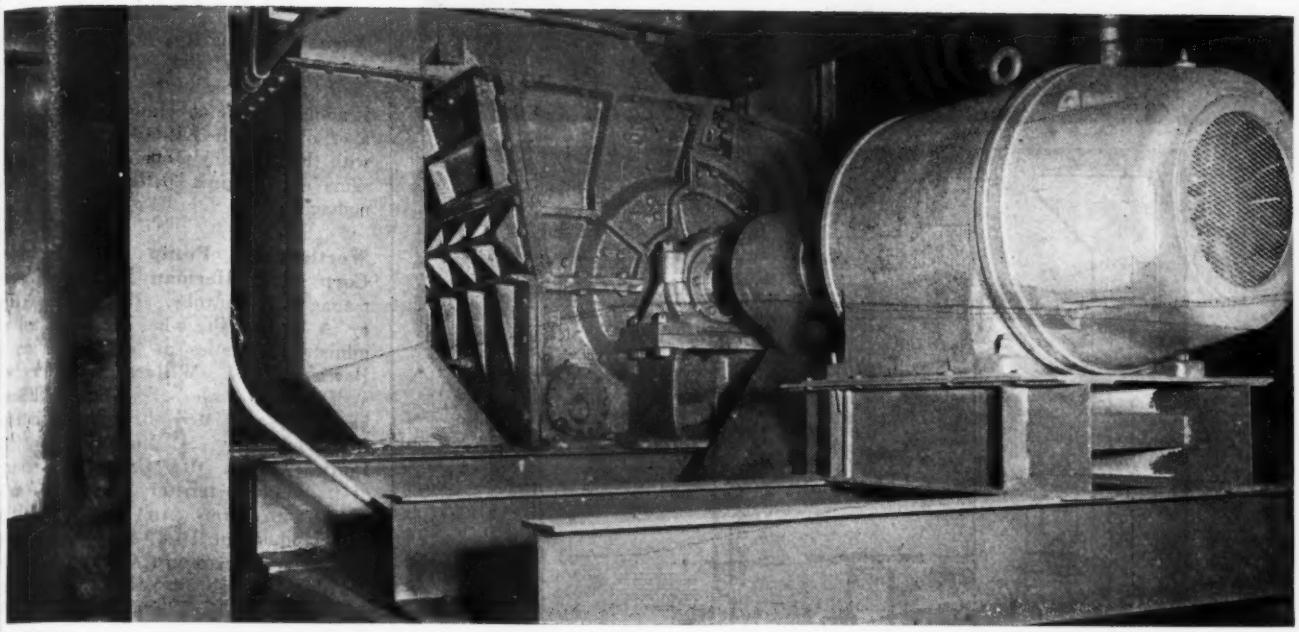
Repair Shop Included

In addition to power-generating equipment described above, there is included as part of the plant a shop with necessary machine tools and equipment for making general operating repairs, a gallery and living quarters for feeding and housing operating personnel and an office for handling administrative work in connection with plant operation. The unit therefore can operate, if necessary, in isolated localities for extended periods of time.

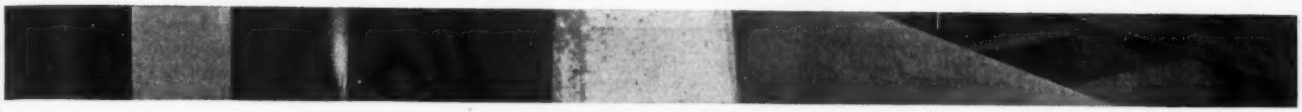
The plant has been in operation about 17 months. During this period it has generated electrical energy for distribution over the power lines of the Mississippi Power & Light Co for serving the area around Vicksburg and Jackson, Miss., and the Gulf Power Co for serving the area around Pensacola, Fla. About 264,724,000 kwhr of electrical energy have been generated to date.

At present the *Inductance* is at Jacksonville, Fla., furnishing power to supplement the power generated by the municipal plant. Because of tremendous load demands on the city power plant, it has not been possible to shut down any of the plant units for needed repairs. With the *Inductance* supplying power into the municipal power system, the city now can shut down some of these power units and make repairs without sacrificing service to the city as a whole.

W A Taylor & Co have increased their production and storage facilities by 50%. Now a larger inventory can be carried and practically all orders filled from stock.



THE PENNSYLVANIA EDISON COMPANY crushes coal for less than 1c per ton



...with an AMERICAN RING CRUSHER

Many power plants have installed AMERICAN ROLLING RING COAL CRUSHERS to prepare coal properly for stoker firing. Shown here is an "American" at the Williamsburg, Pennsylvania plant of the Pennsylvania Edison Company, whose engineers are vitally concerned with efficiency, economy and low maintenance.

Outstanding in economical performance, the "American" has an enviable record in achieving a crushing cost of less than one cent per ton for all charges including power, labor, maintenance and interest on the investment. This low cost is being recorded, not in exceptional cases, but in ordinary, every day service, year after year in plants all over the country and in the crushing of a wide range of coals. The installation shown here is therefore typical, insofar as low operating cost is concerned, with that of all plants in which crushing is done the "American Way."

The wide range of coal being crushed is indicative of the ability of the "American" to meet and solve the most difficult problems in coal preparation. This is an important point to consider now, because it means that regardless of the kind of coal available, the "American" will meet all requirements for uniform sizing at a low per ton cost for crushing.

The patented manganese Shredder Rings in the "American" split the coal and prevent clogging. Each of these rings has twenty cutting edges and maintains an outward position by centrifugal force. Revolved at slow speed, these rings make a minimum of fines. No shear pins or other safety devices are required in the American Ring Crusher, because the rings are free to swing back out of position in the event that they come in contact with tramp iron or other non-crushable foreign materials.

American Ring Crushers are available for crushing coal capacities from 25 to 500 tons per hour.

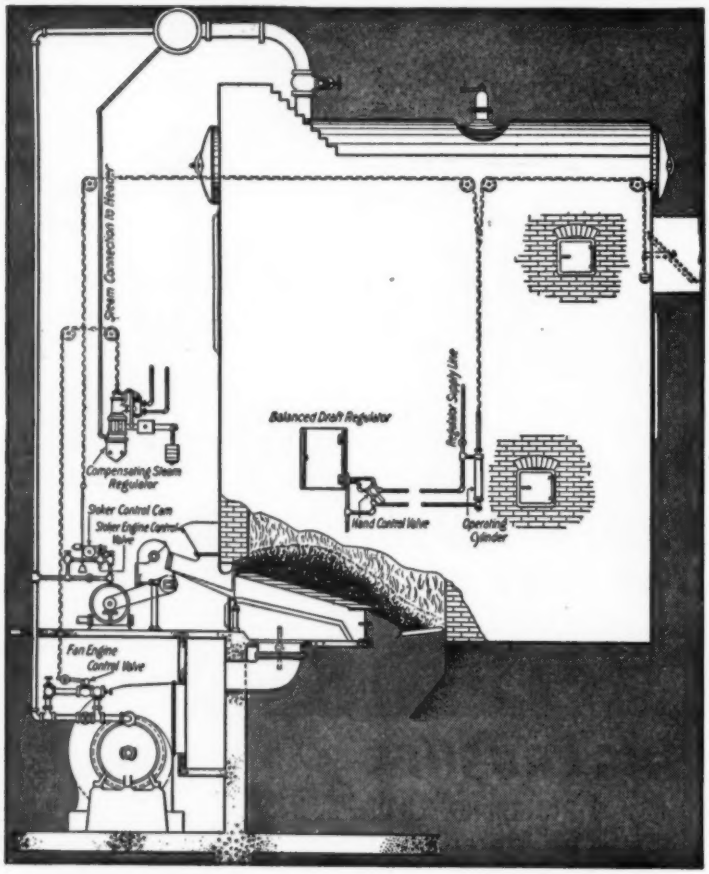
Full information is available promptly on request.

American PULVERIZER COMPANY

Originators and Manufacturers of Ring Crushers and Pulverizers

1349 MACKLIND AVE.
ST. LOUIS 10, MO.

Enco Balanced Draft



A PRACTICAL SYSTEM THAT AUTOMATICALLY CONTROLS

. . . FURNACE PRESSURE, STEAM PRESSURE, FANS AND STOKERS

You can get all the advantages of balanced draft with the Enco system which conforms to accepted practices of combustion control and yet is simple and easy to install and maintain.

It is adaptable to all methods of coal firing . . . stokers of the underfeed, overfeed, spreader or traveling grate types, as well as hand-firing.

The apparatus is so free of complications and delicate mechanisms that it can be installed by your own maintenance crew and kept in operation with the greatest ease.

It may be either hydraulically or pneumatically actuated.

Ask for bulletin B.D. 43 on "Combustion Control" and get the facts on this practical, low cost system that has been in use for over 25 years on more than 1000 boilers.

THE ENGINEER COMPANY
75 WEST STREET (Enco) NEW YORK, N.Y.

APPOINTMENTS

Yarnall-Waring Co started serving t power plants of the nation in July 19 Now, at the beginning of its 38th ye it announces the appointment as sales ma ager of **Joseph Kildare,** long identifi with the company's operations. As of t same date, **Frank Miller** becomes wor manager.

Worthington Pump & Machine Corp names **Herman J Schorle** wor manager of Holyoke. He succeeds Ha **ry A Feldbush,** who has assumed a ministrative duties at general offices i Harrison, N. J. **Willard A Emery** wi assist Mr Schorle. **S Riley Williams** has been appointed director of interna tional business . . . **Jack C Lyle** join **Ludlow Valve Mfg Co** to take charg of its southern territory . . . After thre years with Army Air Forces Trainin Command, **Capt Don Allshouse** rejoi **Northern Equipment Co** as advertisin manager . . . **Ashton Valve Co** announce the retirement of Ellery Peabody. **J W Motherwell** succeeds him as chairman o board. **William P Husband, Jr.,** become president and treasurer.

Fred W Deutsch becomes asst sale mgr of **Builders-Providence, Inc** . . **Daniel A Herrick** has been made manage of sales of d'Este div of **American Chai & Cable Co,** with headquarters in Rea ing, Pa. . . . **Wickwire Spencer** Steel C names **Sidney E McCrum** assistant ad vertising manager . . . **Thermoid Co** elec **John Owen** assistant vice-president. H continues as mgr of industrial rubber di

Westinghouse Electric Internationa Co announces that **Douglas C Lynch** manager of special projects dept, has bee granted leave of absence to serve as tech nical adviser to President Sergio Osmen of the Philippine Islands. **Robert D Mc Manigal** has been made vice-president o company. **Frederick W Rohde** become manager of quality control of aviation gas turbine div of Westinghouse Electric Cor at S Philadelphia, Pa. **Norman C Hurd** has been appointed manager of Cincinnat manufacturing and repair dept.

General Electric Co will found a testing base for flying laboratories at Schenectady County Airport. **C G Talbot** has been ap pointed manager of the new flight test div **N F Frischhertz** is assistant manager. Following appointments in transformer div of GE's central station divisions have been announced: **H M Jalonack** has been made assistant to manager, transformer div, and is succeeded as manager of sales of dis tribution transformer section by **C E Burke. D F Roloff** becomes assistant manager of sales of specialty transformer sec. **E V Dillon** has been made mgr o sales of feeder voltage regulator sec.

General Electric Co establishes the uni equipment div, with **M B Elliott** as man ager. This div consists of two sections— the unit substation section, with **D E Craig** in charge, and unit generating section, with **W N Oberly** in charge. Name of custom div of GE's central station divisions wa

Sales-minded pump maker standardizes on DARCOVA PUMCUPS

WAGENER STEAM PUMP CO.
STEAM PUMPING MACHINERY FOR ALL PURPOSES
SIMPLICITY · ECONOMY · EFFICIENCY · SERVICEABILITY
CANTON, OHIO, U. S. A.

Darling Valve & Mfg. Co.
Williamsport, Pa.

June 1, 1945

Gentlemen:

Subject: Darcova Pumcups

As of this date we are standardizing on DARCOVA PUMCUPS, instead of the more "conventional" packing, for all our piston type pumps. This action is the result of a careful survey and thorough tests.

We consider this change-over to DARCOVA PUMCUPS to be one of the biggest improvements ever made in our piston pumps in our fifty years of steam pump manufacturing.

We are thoroughly convinced that your pumcups will help greatly in keeping Wagener pumps a leader in the steam pump field. Our customers will receive more efficient pumps and will also benefit by very low maintenance cost.

Thanks again for your help in making our pump a better product.

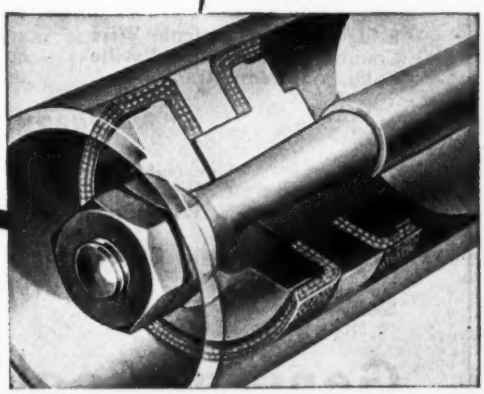
Yours very truly,

WAGENER STEAM PUMP COMPANY

Bernard Schrader

Bernard Schrader, Partner

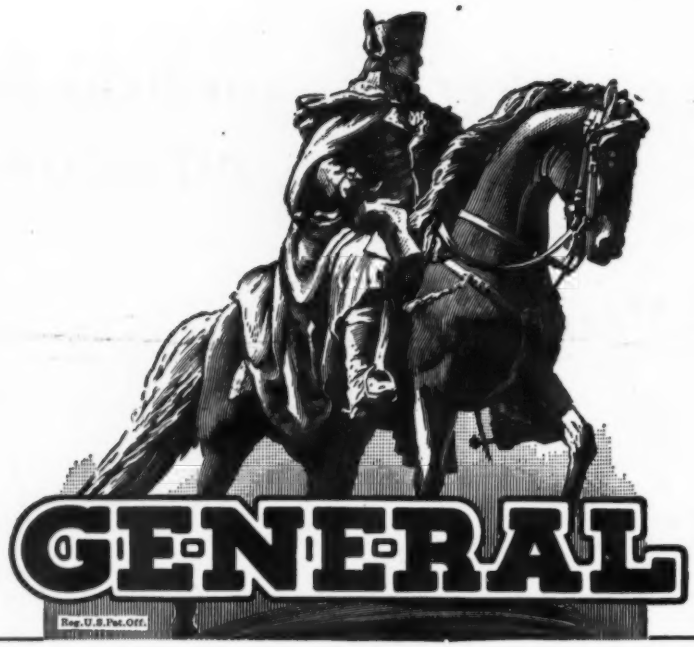
The cup principle, scientifically applied the Darcova way, retains constant high pumping efficiency and prevents fluid slippage despite gradual wear. Exclusive Darcova composition material frequently outlasts other type of piston packing 100 to 1.



Your present pumps, as well as hydraulic or pneumatic pistons, can readily be equipped with Darcova Pumcups of precisely the right size and texture for prolonged efficiency and exceptionally low maintenance. Write to Darling Valve & Mfg. Company, 612 First Street, Williamsport, Pa., for Bulletin No. 4401, and specify Darcova for your new equipment.

DARCOVA
THE ORIGINAL COMPOSITION CUP

DARLING VALVE & MANUFACTURING CO.
WILLIAMSPORT, PA.



RODA

High grade gas, by-product and steam coal from Wise County, Va., on the Interstate Railroad.

DENDRON

High grade gas, by-product, steam and domestic coal from Wise County, Va., on the Interstate Railroad.

STONEGA

High grade, high volatile steam and by-product coal from Wise County, Va., on the Interstate Railroad.

PREMIX STOKER

A laboratory controlled product blended to meet exacting stoker requirements. From Wise County, Va., on the Interstate Railroad.

COKE

Roda and Stonega from Wise County, Va., and Connellsville Coke from Pennsylvania.

CRITERION COAL

High grade gas, by-product, steam and domestic coal—Pittsburgh seam from Irwin Basin, Westmoreland County, Pennsylvania, on the Penna. Railroad.

CROZER

Genuine Third Vein Pocahontas from McDowell County, W. Va., on the Norfolk & Western Railroad.

Admiralty Coal

Genuine New River Smokeless, Beckley or Sewell seam from Raleigh County, W. Va., C. & O. and Virginian Railroads.

Old Kentucky

Hazard No. 4 and No. 7 steam and domestic coal from Wiscoal, Knott County, Kentucky, on the L. & N. Railroad.

CHARMCO

Unexcelled Steaming Coal from the Fire Creek Seam in Greenbrier County, W.Va., originating on the N.F.&G.R.R.

ANTHRACITE — Hazle Brook Premium . . . Raven Run

FOR VICTORY BUY UNITED STATES WAR BONDS AND STAMPS

General Coal Company

123 SOUTH BROAD STREET, PHILADELPHIA 9, PA.

BRANCHES:

BLUEFIELD, W. VA. BOSTON BUFFALO CHARLOTTE, N. C.
CINCINNATI DETROIT NEW YORK NORFOLK PITTSBURGH

changed to electric utility div, with **R W Beard** appointed manager. The div has divided the country into three areas by districts, with following men in charge: **E N Chilberg,** Atlantic, East Central and Southeastern; **R R Owen,** Central, Southwestern and Rocky Mountain; and **A J Tracy,** New England, New York, Pacific and Northwestern. Also, **W H Norris, Jr.,** is responsible for power projects and **W H Branch** contractor business.

American Locomotive Co announces appointment of **Gus H Sample** as technical assistant to director of engineering, diesel div. Mr Sample will be located at Schenectady, N. Y. . . . . **Whiting Stoker Co** adds **Lloyd W Hemingway** to engineering development staff . . . **R B Zane** retires as sales engineer for Michigan and northern Indiana territory of **Bird-Archer Co.** Chemical engineering services will be carried on in this area by **Sylven E Lawson** of Detroit under direction of Edward A Lowenthal, western manager, Chicago office.

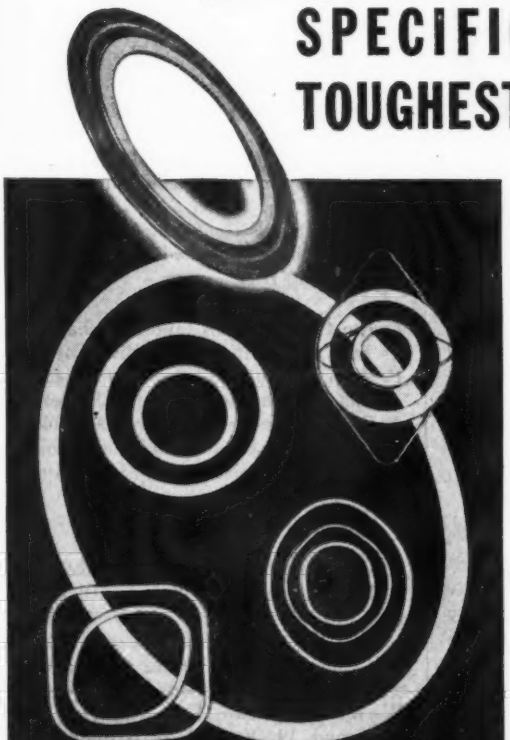
Allis-Chalmers Mfg Co, tractor div, makes following appointments: **Marshal L Noel** becomes general sales manager and **William J Faulkner** industrial sales manager. Assistant industrial sales managers are **F B Harrison** and **E G Kullmann. H A Gratner** will be made agricultural sales manager and **Louis Adams** harvester line sales manager. **S H Sorensen** will be assistant harvester line sales manager. **Ernest Franks** has been placed in charge of wheel tractor sales for industrial purposes, in addition to his former duties as manager of power unit sales. **Boyd S Oberlink** becomes assistant to vice-president, tractor div.

Square D Co announces formation of Square D de Mexico for manufacture of electrical distributing and control equipment for the Mexican market. Square D de Mexico will be owned jointly by U. S. company and Mexican industrial leaders. Officers of new company will be residents of Mexico. **F W Magin** and **Lauron W Mercer,** vice-president and general sales manager of the domestic company, will represent Square D Co on board of directors . . . **Norman A Hayes** is taking over duties of merchandising manager for **Graybar Electric Co** in Portland, Ore. . . . **William Sellers & Co** announces appointment of **John C Graf** as sales manager of hydraulic and special machinery div . . . **Carl B McLaughlin** will head the engineering service div of **Tube Turns, Inc.**

Joshua Hendy Iron Works appoints **Charles A Butcher** assistant general manager of Crocker-Wheeler div . . . **Armin G Kessler** becomes manager of sales of **Farrel-Birmingham Co** in midwestern district, with headquarters in Akron, Ohio . . . **Reliance Electric & Engrg Co** elects **A S Knoizen** a director, replacing **John D Fackler** who resigned as a member of board but remains as legal counsel . . . **W Marshall Dale** has been appointed executive vice-president of **Bowser, Inc. Col Frank H Higgins** becomes president of **Fostoria Screw Co,** a subsidiary of Bowser . . . **Foxboro Co** announces re-

"Flexitallic"
REG. U. S. PAT. OFFICE
GASKETS

SPECIFICALLY DESIGNED FOR THE TOUGHEST APPLICATIONS IN THE WORLD



THE ORIGINAL SPIRAL WOUND GASKETS
Fully patented — specifically designed for the working pressures— made ONLY by Flexitallic.

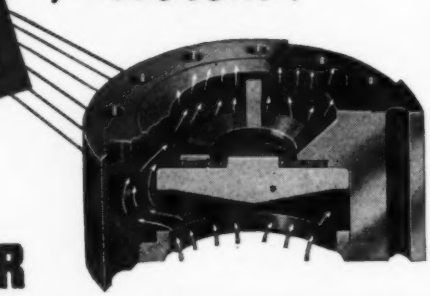
No gasket in the world can match the Flexitallic spiral wound gasket in standing the terrific strains of naval and maritime operation! What's more, the ease of installing Flexitallic Gaskets means a 25 to 30% speed-up in pipe fabricating schedules. Only recently, Flexitallic Gaskets used on a critical large scale piping schedule resulted in a reduction of 2500 man hours — and this exclusive of time saved on pipe preparation!

Spiral-wound Flexitallic construction automatically compensates for pressure surges, vibration, expansion, contraction. Bolt tension is controlled by gasket yield. Seal with Flexitallic and it stays sealed — even under the most hazardous wartime marine service conditions!

FLEXITALLIC GASKET CO. 8th & BAILEY STS. CAMDEN, N. J.

THERE'S NO MARINE GASKET PROBLEM FLEXITALLIC CAN'T BEAT!

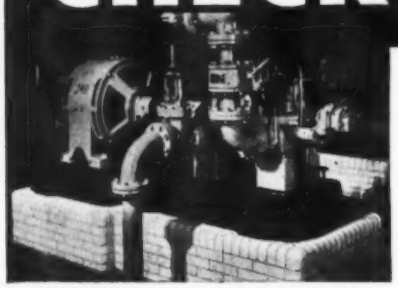
THIS NEW INFORMATIVE CATALOG WILL SOLVE YOUR "WATER HAMMER" *Problem!*



WILLIAMS-HAGER

FLANGED *Silent*

CHECK VALVES



A Williams-Hager Valve in the Metropolitan Life Building, New York.

- *Precision Engineered*
- *Economical*
- *Efficient*
- *Frictionless*
- *Tight Under Every Operating Condition or Pressure up to 6000 Lbs.*

Williams-Hager Flanged Silent Check Valves completely eliminate "Hammer" and "Bang" in the lines, provide uninterrupted constant flow of liquids.

Unlimited in size or application, from 1" to 20", built of materials to best suit the end use, Williams-Hager Flanged Silent Check Valves have been chosen for years as standard equipment in such exacting line uses as oil, gasoline, acids, water, chemicals, gas, air, salt water, brine, etc., regardless of temperature.

Write today for YOUR copy!

THE WILLIAMS GAUGE COMPANY

Pump Valves . . . Water Gauges . . . Gauge Cocks . . . Pump Governors . . . Steam Traps Feed Water Regulators . . . Water Columns

2055 Pennsylvania Ave. **Pittsburgh, 12, Pa.**

opening of its branch office at Charlotte, N. C. **Samuel C Alexander,** 2012 E 7th St, is the resident engineer in charge.

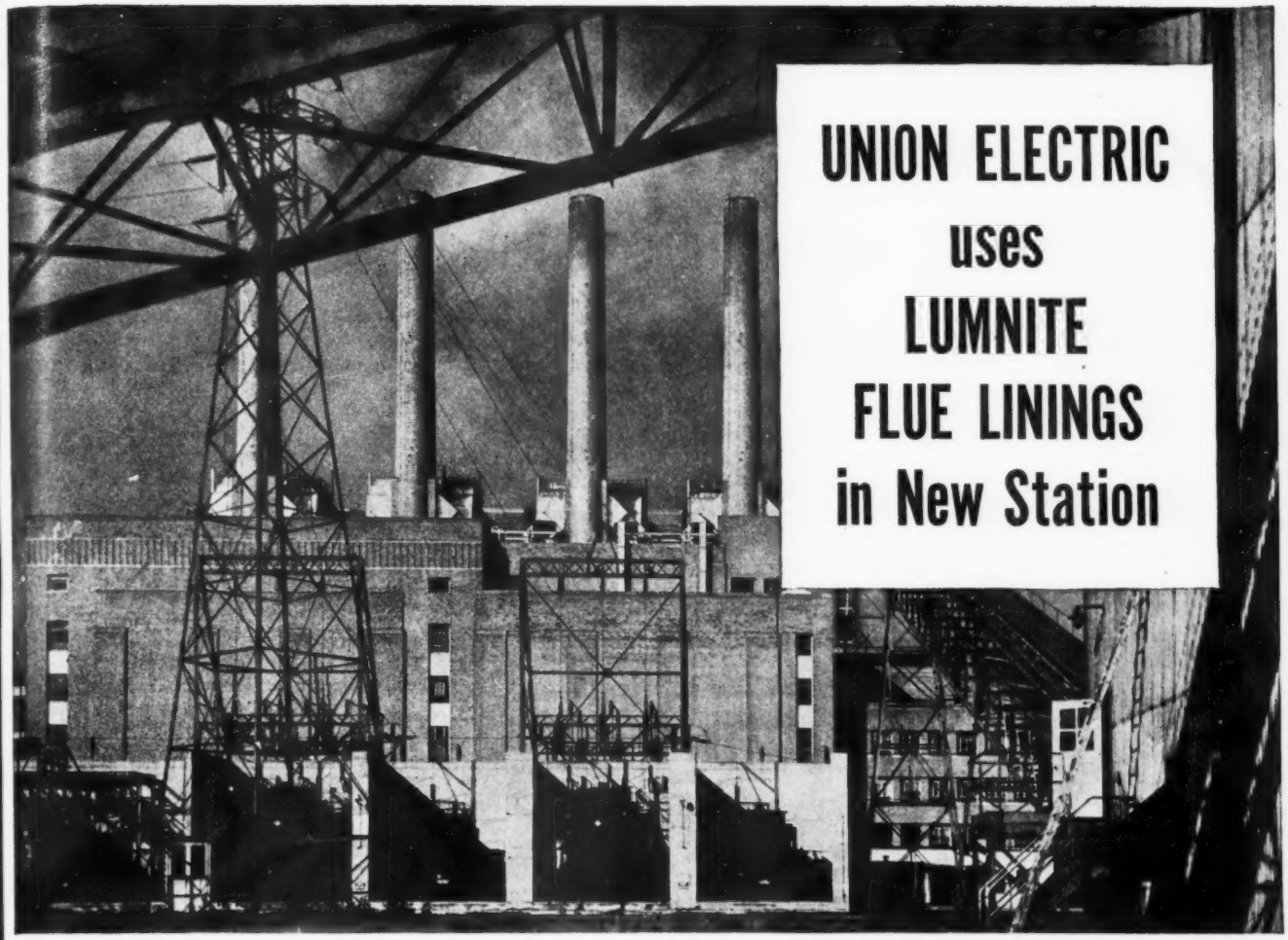
Cutler-Hammer, Inc, elects following officers: **F R Bacon,** chairman of board; **H F Vogt,** chairman of executive committee; **G S Crane,** president; **H F Vogt,** vice-president and treasurer; **J C Wilson,** vice-president and secretary; **P B Harwood,** vice-president in charge of engineering; **P S Jones,** vice-president in charge of sales; **Philip Ryan,** vice-president in charge of manufacturing; **E W Seeger,** vice-president in charge of development and assistant secretary; **M R Fenno,** assistant treasurer; **J C Springer,** assistant secretary. **F R Bacon** and **G S Crane** were appointed as the other members of the executive committee.

Farrel-Birmingham Co appoints **Robert M Honegger** general manager of gear plant at Buffalo. **Lester D Chirgwin** becomes vice-president in charge of manufacturing in all four plants located at Ansonia, Derby and Stonington, Conn., and Buffalo, N. Y. . . . **Cleveland Pneumatic Tool Co** promotes **Elmer J Steger** to manager of Cleveland rock drill div and **Charles E Vanderpool** to sales manager of pneumatic tool div. **Albert H Hruby** becomes sales manager of rock drill div and **Robert Craig** has been named manager of export sales . . . **Thermoid Co** places **H W Overman** in charge of industrial friction materials . . . **Peabody Engrg Co** appoints **Donald S Jackson** sales agent for Conn. His address is P O Box 1945, New Haven . . . **C Emery Nelson, Inc,** 831 E Hennepin Ave, Minneapolis 14, has been appointed agent for **Kieley & Mueller, Inc.**

Crane Co announces following changes in its sales and branch house div: **Carter T Pollock** is appointed manager of central district, with headquarters in Chicago; **W A Burbine** is made manager of Chicago branch; **A N Rosborough** is appointed manager in Cleveland; **W D LaRue** is promoted to managership of Toledo; and **R C Danielson** manager of Muncie.

International Nickel Co announces that **E J Hergenroether** has resumed his duties with development and research div . . . **W B Connor Engrg Corp** appoints following to handle line of Dorex adsorption equipment and Kno-Draft diffusers: **W Wallace Neale Co,** 16½ N 9th St, Richmond 19, Va.; **D R Rippey,** West Bldg, Houston 2, Tex.; **Walter Cooke,** 816 Howard Ave, New Orleans, La. **Joe P Dillard,** 1011 Camp St, Dallas 2, Tex., handles Kno-Draft diffusers only.

Baldwin Locomotive Works will open a headquarters in Paris in Sept to provide coverage for Baldwin's heavy machinery in France and its colonies, Belgium and Holland. **Thomas Butts** will direct the new office . . . **A M Lockett & Co, Ltd,** appoints **George R Hammett** manager of sales of New Orleans district office, succeeding **R P Lockett** who has been elected a vice-president . . . **Mercury Clutch Corp** moved to new plant at 1520 12th St,



UNION ELECTRIC uses LUMNITE FLUE LININGS in New Station

Union Electric Company's Venice No. 2 Station, near St. Louis
Stone & Webster Engrg. Corp., Boston, Engineers and Constructors
Gunite Concrete Construction Co., St. Louis, Cement-Gun Work
Wiederholt Construction Co., St. Louis, Chimneys

Lasting Protection for Uptake Flues and Fly-ash Precipitators

Burning 2880 tons daily of Illinois coal sets up serious abrasion and corrosion threats from ash and sulphur. In its new 160,000-kw station at Venice, Illinois, the Union Electric Company serving Greater St. Louis protected its uptake breechings and fly-ash precipitators against these hazards by installing LUMNITE linings.

The protective linings, of concrete made with LUMNITE cement and Haydite aggregate, were "shot" on by cement gun over reinforcing wire mesh previously attached to the steel. This method of application provided a solid, unbroken protective layer that covered seams, rivets, bends and corners, and hard-to-get-at places as well as the more accessible flat surfaces. Intimate contact between the LUMNITE concrete and the steel shell prevents moisture and gas from attacking the steel. The thin layer of LUMNITE concrete—two inches—also gives adequate insulation with minimum reduction of draft area.

In the chimneys, 125 feet high (above roof), LUMNITE mortar was used for laying the brick linings—assuring protection against attack by sulphurous fumes and moisture. Some intermittent operation of the plant is anticipated, with the resulting low-temperature periods that permit formation of corrosive condensate within the stacks. Union Electric had previously used LUMNITE mortar in chimney linings in their Cahokia and Ashley Street Stations and found it an effective method of controlling corrosion.

Many power plants use LUMNITE for a variety of purposes, such as:

* **Ash Pit and Cinder Catcher Linings**
* **Coal Bunker Linings**
* **Flue and Duct Linings**
* **Linings for Steel Stacks**
* **Mortar for Brick Chimneys and Linings**
* **Castable Refractories**
* **Overnight Structural Concrete**

Write for further information on the use of LUMNITE in power plants.

THE ATLAS LUMNITE CEMENT COMPANY

(United States Steel Corporation Subsidiary)

Chrysler Building · New York 17, N.Y.

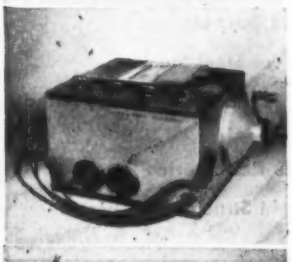
WHICH "MEGGER" INSULATION TESTER is Best for You?

THE "Megger" line of instruments for testing electrical insulation is complete for ranges from a fraction of an ohm to 10,000 megohms, between which limits practically every insulation resistance measuring requirement falls. There are specific instruments for specific requirements and other types for more general use. Some users find one instrument suitable for all work, while others have use for several types.

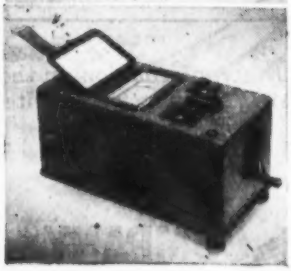
If you are uncertain which type and range of "Megger" instrument is best for your particular needs, write us, telling the type, size and rating of your equipment. We will gladly make recommendations. Write also for *Pocket Manual of "Megger" Practice*, No. 1420-*P*.

The New U. S.-Made Midget "Megger" Tester—*In many ways the most remarkable "Megger" instrument ever built. Weighs only 3 lbs—will fit an overcoat pocket or tool kit. Reads up to 50 megohms. Generates 500 volts and is always ready for use anywhere because of the hand crank. Bulletin 1785-P.*

The U. S.-Made "Megger" Insulation Tester—*Contains the usual "Megger" direct-reading true ohmmeter, of the permanent magnet moving coil type, mounted with a d-c hand generator in a plastic molded case. Ranges up to 2000 megohms, with hand generators up to 1000 volts. Widely used in hard service. Variable-pressure ("Meg") and constant-pressure ("Super-Meg") types. Bulletin 1735-P.*



The "Bridge-Meg" Resistance Tester—*This instrument is a combined "Megger" Insulation Tester and a four-dial, multi-ratio Wheatstone Bridge. Will measure any ohmic resistance from .01 ohm up to 100 or 200 megohms; hand generators rated up to 1000 volts. A complete and compact unit that is ideal for power companies and industrial plants. Catalog 1685-P.*



High-Range "Megger" Testing Set—*The original heavy-duty type "Megger" Testing Instrument. Made in all ratings up to 10,000 megohms and 2500 volts. A combination high-potential testing and insulation resistance measuring set. Hand- and motor-driven types. Catalog 1685-P.*

JAMES G. BIDDLE CO. • **1211-13 ARCH STREET PHILADELPHIA 7, PA.**

S W, Canton, Ohio . . . **Stone & Webster, Inc,** elects **Lt Col Whitney Stone** president, succeeding **George O Muhlfeld** who now becomes vice-chairman of board of directors . . . **J B Linker** joins **Calumet and Hecla Consolidated Copper Co** as supt of power plants and assistant to general master mechanic.

Georgia Power Co elects **P S Arkwright** chairman of board and **W E Mitchell** president. **C B McManus** was made a member of board and assistant to the new president . . . **Refrigeration Equipment Manufacturers Assn** appointed F J Hood president . . . **American Society of Heating and Ventilating Engineers** appoints Herbert B Nottage research associate on staff of the research laboratory . . . Elton Sterrett has been made executive secretary of **National Assn of Corrosion Engineers.**

American Institute of Electrical Engineers elected following officers: *President*—Dr William E Wickenden. *Vice-Presidents*—E S Fields, H B Wolf, L M Robertson, F F Evenson, F L Lawton. *Directors*—J M Flanigen, J R North, Walter C Smith. *National Treasurer*—W I Slichter.

First York Corp and Utility Equities Corp have obtained a substantial interest in **American Foundry Equipment Co.** The management remains as at present. In addition, **R Sherrard Elliot, Jr,** has become secretary. Board of directors is now as follows: Verne E Minich, Otto A Pfaff, Albert M Austin, Charles Ogsbury, David M Milton, Ellery C Huntington, Jr, and R Sherrard Elliot, Jr.

CURRENT AWARDS

Foster Wheeler Corp, Farrel-Birmingham Co, American Blower Corp and **Independent Pneumatic Tool Co** have received five stars for their "E" flags. **Maxim Silencer Co** received fourth star.

Askania Regulator Co and **John Reiner & Co** were awarded third stars. **Charles Lennig & Co** was given two stars for its flag. **Babcock & Wilcox Co, United Transformer Corp** and **Vita-Var Corp** have won stars for their "E" flags.

OBITUARIES

Frederick C Renner, 44, general manager of sales of organic chemicals div of Monsanto Chemical Co, died of heart disease on June 26 at Deaconess Hospital, St. Louis.

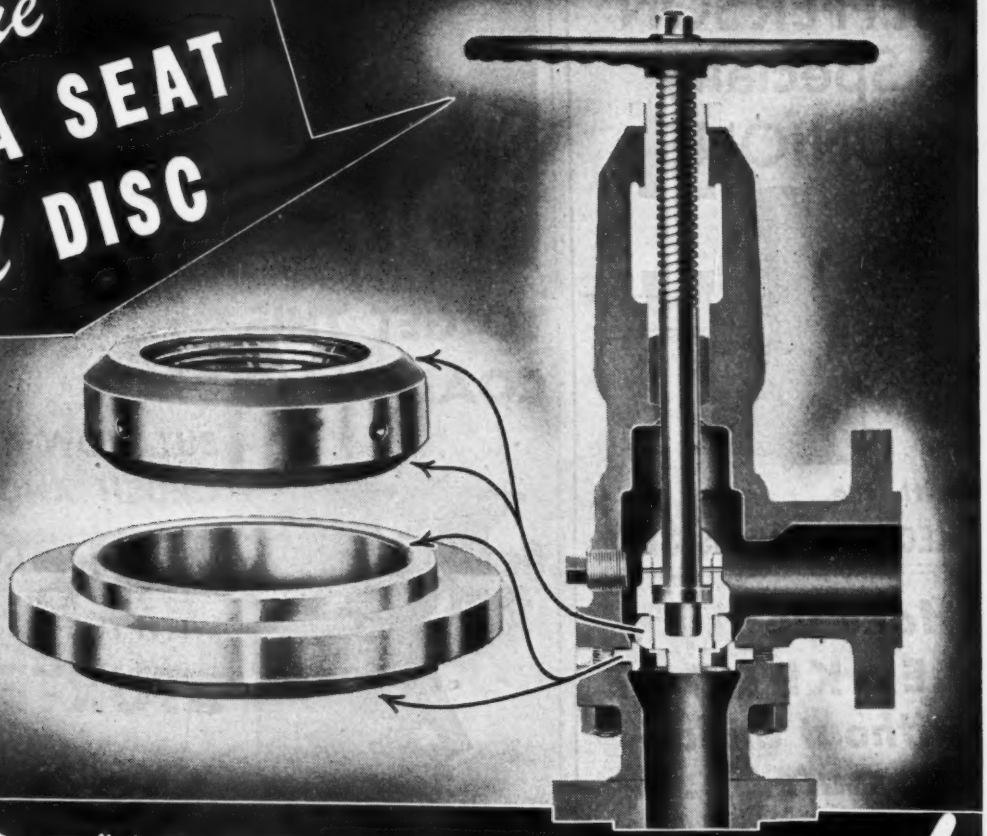
Myron J Czarniecki, 53, vice-president in charge of sales for A M Byers Co, died suddenly on June 18 near Pittsburgh.

David Owen Evans, 69, vice-president of International Nickel Co of Canada, Ltd, and chairman of Mond Nickel Co, Ltd, died of a heart ailment in London on June 11.

William L Dankmyer, 67, assistant treasurer of Allegheny Ludlum Steel Corp, died May 27 at his home in Aspinwall, Pa.

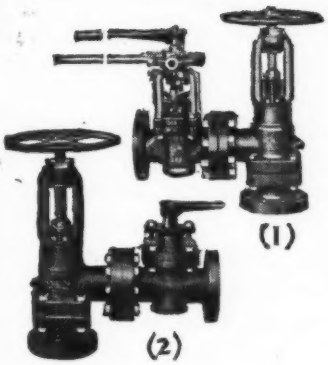
Graham Smith, 69, former manager of San Francisco office of Crane Packing Co, died on May 5 in Palo Alto, Calif.

The EXTRA SEAT and DISC



DOUBLE LIFE
"Spare" seat and Disc in every "HOVALCO" Simply turn them over for good-as-new valve.

mean DOUBLE SERVICE LIFE!



Hovalco Angle Valves used in combination with (1) Homestead Lever-Seald or (2) Cam-Sealed Quarter-Turn Valves meet the requirements of A.S.M.E. code and all state laws for boiler blow-off service. Made in 1½"—2"—2½" sizes for pressures up to 600 pounds.

HOVALCO BOILER BLOW-OFF VALVES

- *Are built to outlast the boiler*
- *Reduce maintenance costs by 30% to 60%*

Inside every HOVALCO BOILER BLOW-OFF VALVE is an "extra" set of accurately-ground, perfectly-matched *seating surfaces* ready to be put into service quickly and easily, when the need arises. By simply unbolting the lower valve body and turning over the special high-silicon monel seat and disc, you have a good-as-new valve ready to give *another* extra long lifetime of service.

That's why Hovalco Blow-Off Valves give double-service life and often outlast the boiler on which they are installed. Also, certified performance records show that their maintenance costs are 30% to 60% lower than those of other valves.

For double service life and lowest cost-per-year maintenance, specify HOVALCOS for your next boiler blow-off job. Choose sizes and types for your condition from Valve Reference Book No. 38. Write today.

"M" Pennant with three additional gold stars—Maritime's highest production award to our men and women making valves for the Victory Fleet.

HOMESTEAD VALVE MFG. CO.

P.O. BOX NO. 210 CORAOPOLIS, PA.

W

"MEGGEF

is

ED BRASS SEAT

ke up
EAKPROOF
without undue
Pressure . . . .

These All-Female and Male and Female Union Tees are used in place of an all-female union, two nipples, and an ordinary tee. Their use means the saving of three joints, a lot of space and expense as well as the assurance of far better results.

Jefferson is prepared to furnish also REDUCING UNION TEES in some sizes.

Coupled with the greater convenience of Jefferson Specialty Unions are the advantages offered by the Recessed Brass Seat which assures leakproofness, self seating and a free flow through pipe without possibility of pipe ends coming in contact with the seat.

For full details, get in touch with your nearest distributor or write us direct.

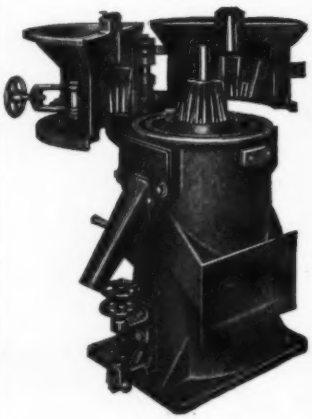
JEFFERSON UNION COMPANY

601 W. 26th St., New York 1, N. Y.

Factories at
Lexington 72, Mass.
Lockport, N. Y.

IT USED TO TAKE 32 OPERATIONS

TO GET THIS COAL SAMPLE!



BUT NOW YOU CAN CRUSH AND SAMPLE

1 TON IN 1 HOUR

WITH THE

STURTEVANT

Automatic

CRUSHER *and* SAMPLER

Times change! It used to be ok to have one or two men devote hours to "sampling" a pile of coal. But today you can get BETTER results — FASTER — delivered to your laboratory by the Sturtevant Equipment shown here. This is MODERN equipment. It meets the modern demand for a better quality coal to meet the increasingly SPECIFIC requirements of modern plants. The FIRST STEP in laboratory-control of coal QUALITY is to get accurate samples quickly and at low cost. This the Sturtevant Coal Crusher and Sampler does without hand labor. Proven by the test of actual service in modern collieries. Can be depended upon as reliable equipment. Simple, rugged, easily adjusted and maintained — and ACCURATE. The ideal combination with this Sampler is the STURTEVANT FINE GRINDER.

(Refer to our "AD" in the August issue of Power—Page 209)

HERE IS THE IDEAL COMBINATION TO SPEED LABORATORY CONTROL AND INSURE RESULTS !

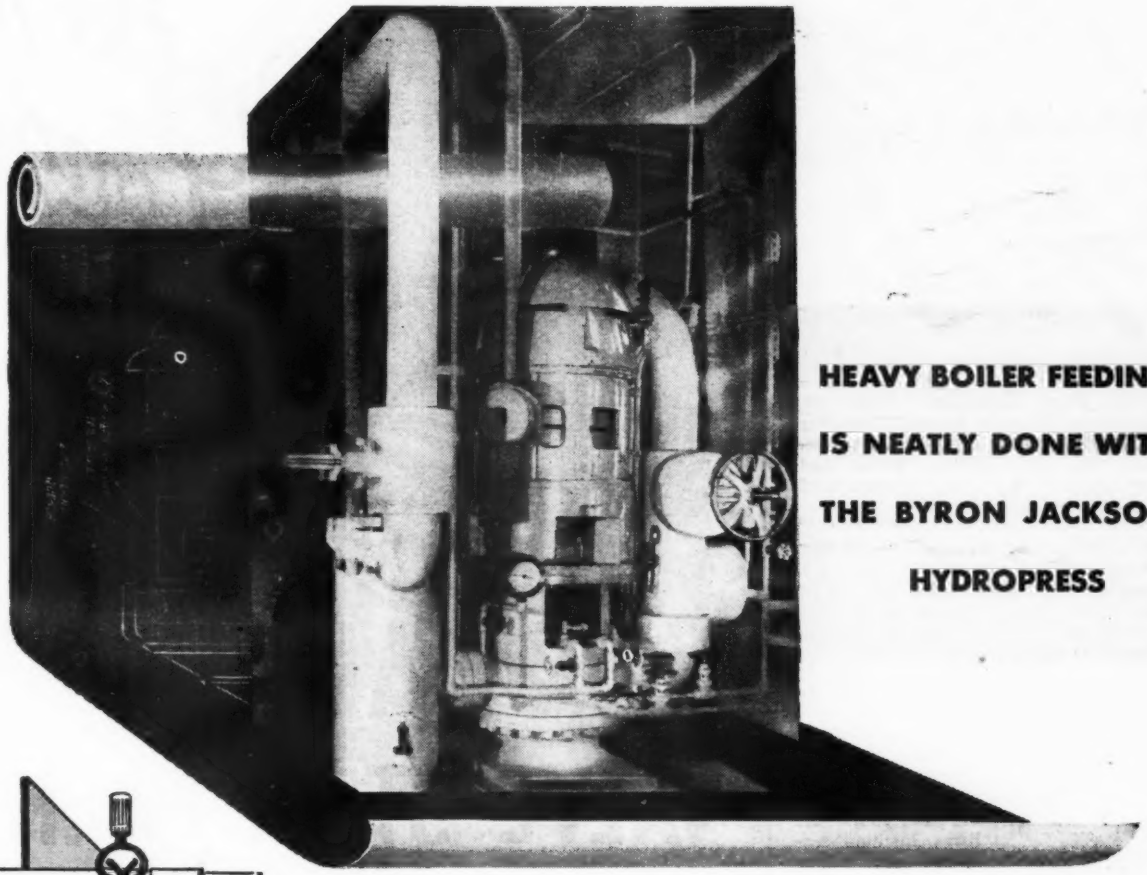
Investigate the "STURTEVANT WAY"—NOW!

Send at once for illustrated booklet containing valuable information on coal sampling and the big accomplishments realized in leading plants through using "STURTEVANT" automatic method.

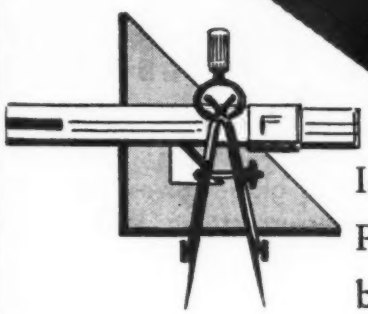
Sturtevant Mill Co.

103 Clayton St., Dorchester, Boston 22, Mass.

IN 2 BY 5 BY 8



HEAVY BOILER FEEDING IS NEATLY DONE WITH THE BYRON JACKSON HYDROPRESS



Installed in 1940—this 15″ 16-stage Hydropress Boiler Feed Pump, with its 150 hp, 2300 volt, 3600 rpm motor, requires but ten square feet of floor space, yet provides 100,000# per hour at 850 psi.

Particularly advantageous where the npsh is limited, the Hydropress is but one of three types of pumps especially developed by Byron Jackson for Boiler Feed Service.

Capacity and pressure conditions can be met and limitations of available floor space and npsh can be overcome. Let's discuss your particular problem.

CENTRIFUGAL AND TURBINE PUMPS
SUBMERSIBLE MOTORS

BYRON JACKSON CO.
Houston • LOS ANGELES • New York

Combustion efficiency as applied to Boiler Plant Operation, Fuels and Equipment is now a most important factor in defense work. Fuels cost more than ever before. Boiler loads are heavier. A scarcity of some kinds of fuel is apparent.

The Combustion trained man—the Hays trained man — can do his part, and open up big opportunities for himself that never existed before, by devoting a little of his spare time in training himself to meet present conditions.

Just a Few of Our Hundreds of Friends	
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Armour and Co.	75
Combustion Engineering Company	45
Riley Stoker Corp.	75
Iron Fireman Mfg. Co	35
Commonwealth Edison Company	145
State of Illinois.	85
Cities Service (Oil & Power).	70
and many others.	

How? Through the simple, easy reading, *practical* Hays Home Study Course in Fuel and Combustion Engineering. For 26 years the Hays Institute has specialized exclusively in training in Combustion Efficiency. Hundreds of Hays trained men now hold substantial positions of responsibility. What we have done for them we can do for you, in your spare time. Many companies urge their men to enroll. They know the value of Hays Combustion Training.

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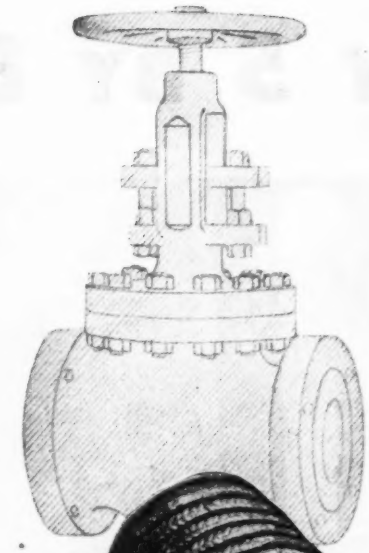

On the Job Longer!

GOODALL VALVE STEM PACKING

STYLE A-470 BRAIDED **STYLE A-471 TWISTED**

This is for all general service on angle or globe valves having sma packing spaces where high or low pressure steam, water, oil an air must be handled.

Made of Canadian long fibre asbestos yarn, carefully impregnate strand-by-strand with a heat resisting lubricant and thoroughl graphited before braiding or twisting.

Sizes:
Style A-470, Braided—⅛" to ¾"; Style A-471, Twisted—1/16" to ¾".

"LONG-LIFE" TAN FIBRE PACKING

For use on bolted flange connections on hot or cold water, oil, gasoline, compressed air, inert gases, etc., where it does not come in direct contact with fire or flame.

OTHER PACKINGS, GASKETS, RING

Rubber, Synthetic Rubber and Fibre Sheet Pac ings; "Long Life" Lip Packings; Flax Packing Plain and Cloth-Inserted Flat Rubber Gaskets an Rings; Pure Gum Sheets and Strips.

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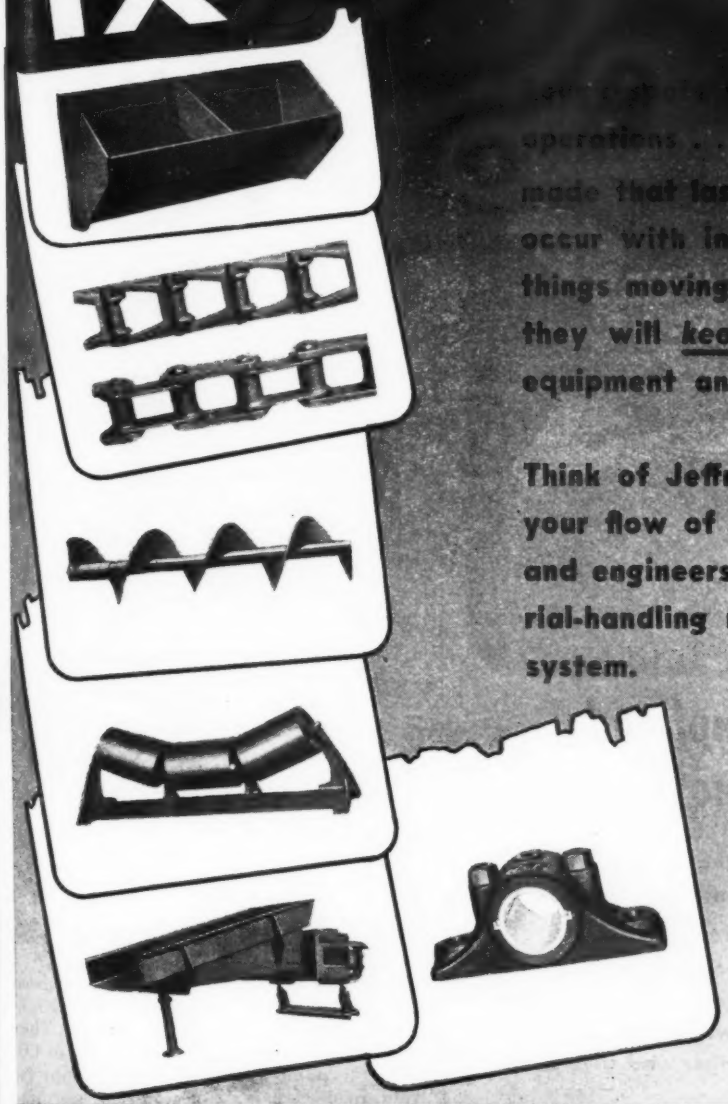

operations . . . no machine or part has yet been made that lasts forever. Nowadays, breakdowns occur with increasing frequency. You can start things moving again with greater assurance that they will *keep moving* by relying upon Jeffrey equipment and replacement parts.

Think of Jeffrey when a rough spot develops in your flow of operations. Jeffrey has technicians and engineers to help you coordinate your material-handling requirements into a smooth-running system.

FOR HIGH PRODUCTIVITY . . . . . SPECIFY JEFFREY

CHAINS
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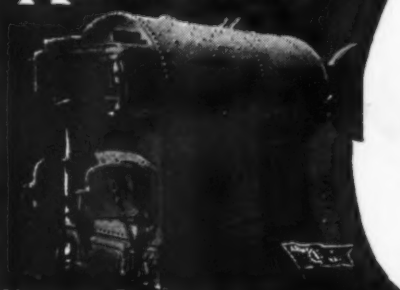
Los Angeles 54 . Cincinnati 2 . Passaic 12 . Philadelphia 19 . Scranton 2

EXTRA STRENGTH FOR HEAVY DUTY

KEWANEE



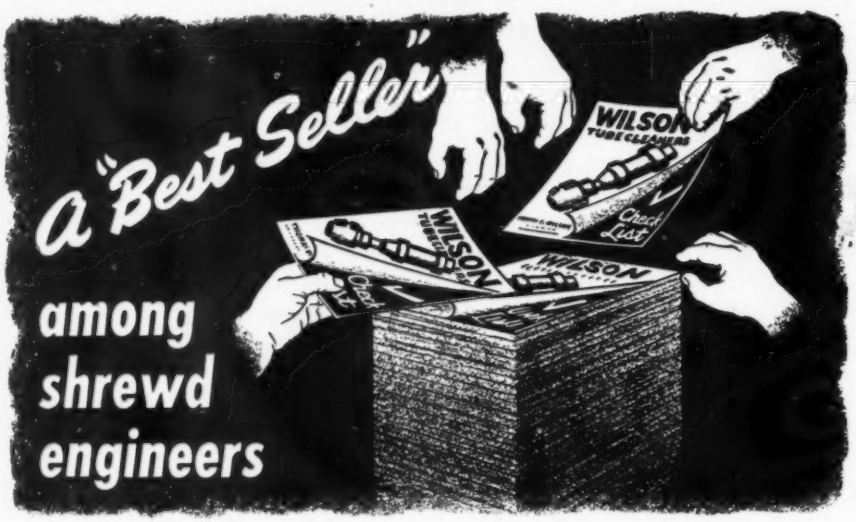
KEWANEE BOILER CORPORATION
KEWANEE, ILLINOIS

Steel Plus Rivets

Steel plus Rivets further strengthened by extra stout stays and braces. Embodies all characteristics which make firebox type boilers especially adapted for high pressure.... 4 to 304 H. P. 100, 125, 150 lbs. W. P.

75 Years
Boilermakers

Write Department 96-K8 for 6" scale with pipe diameter marking.



—another reprint just completed . . . get your free copy now!

Yes, the same Wilson Tube Cleaners Check-List that found such wide acceptance in its original edition, has just been reprinted—and it's available to you for the asking.

This six-page folder gives valuable hints on tube cleaner maintenance and operation that will show you how to save wear and tear on your tube cleaning equipment. These suggestions will go a long way toward making your present equipment last longer and give better service.

Moreover, there is a two-page Tube Cleaner Selection Guide that will help you choose the right Wilson Tube Cleaning Motor, Cutter Head and accessory to get your job done faster and more efficiently with minimum damage to tube walls.

Your copy of the Wilson Tube Cleaners Check-List will be sent on request—and without obligation, of course.

wilson

TW-691

THOMAS C. WILSON Inc.
21-11 44th AVENUE, LONG ISLAND CITY 1, NEW YORK

Ranarex cuts up-the-stack loss as much as 20%

Here's a simple way to get more power from the fuel you burn: Just measure the CO_2 in flue gas with the Ranarex* instrument. Then regulate combustion until percentage of CO_2 is at the point known to be just right for your load. Ranarex gives instant, accurate readings—yet it contains no fragile parts and doesn't get out of order easily.

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IN OVER 12,000 BOILER PLANTS

Because it has no seat to score, wear and clog with mud, scale and dirt, the Yarway Seatless Blow-Off Valve today is "standard" in over 12,000 plants.

Power plant operators hailed this Yarway seatless-design valve instantly when it was first introduced more than a quarter-century ago. It eliminated the source of continual trouble and expense prevalent with conventional type blow-off valves.

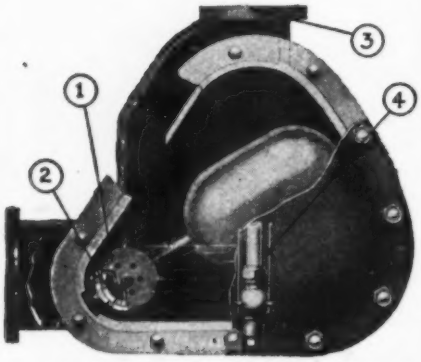
Since then constant mechanical and metallurgical research, anticipating new and more rigid service requirements, has made today's highly improved Yarway Seatless Blow-Off Valve even better insurance against boiler blow-down troubles.

There is a Yarway Valve for every pressure. The Type "C" Seatless Tandem shown is for pressures up to 600 psi. For pressures from 400 to 2500 psi ask for Bulletin B-432; for pressures up to 400 psi ask for Bulletin B-424.

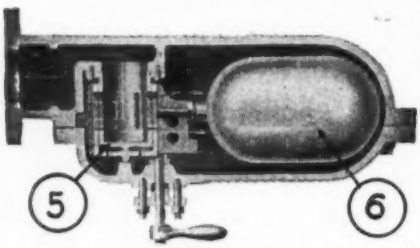
YARNALL-WARING COMPANY
100 Mermaid Ave., Philadelphia 18, Pa.

YARWAY BLOW-OFF VALVES

Extraordinary Discharge Capacity



COCHRANE DRAINER



1 Valve absolutely balanced; does not bind or stick; water sealed; never leaves its seat; self-cleaning; has large ports for handling water rapidly and less operating pressure is required to expel condensate; pilot valves are unnecessary; no stuffing boxes, packings, springs or links; valve can be held open by handle on cover.

2 Valve Seat; a sleeve with longitudinal ports; removable after loosening screws.

3 Inlet at top; no possibility of trap becoming air bound; deflector prevents entering water from striking float.

4 Gauge glass, with guards and try cock.

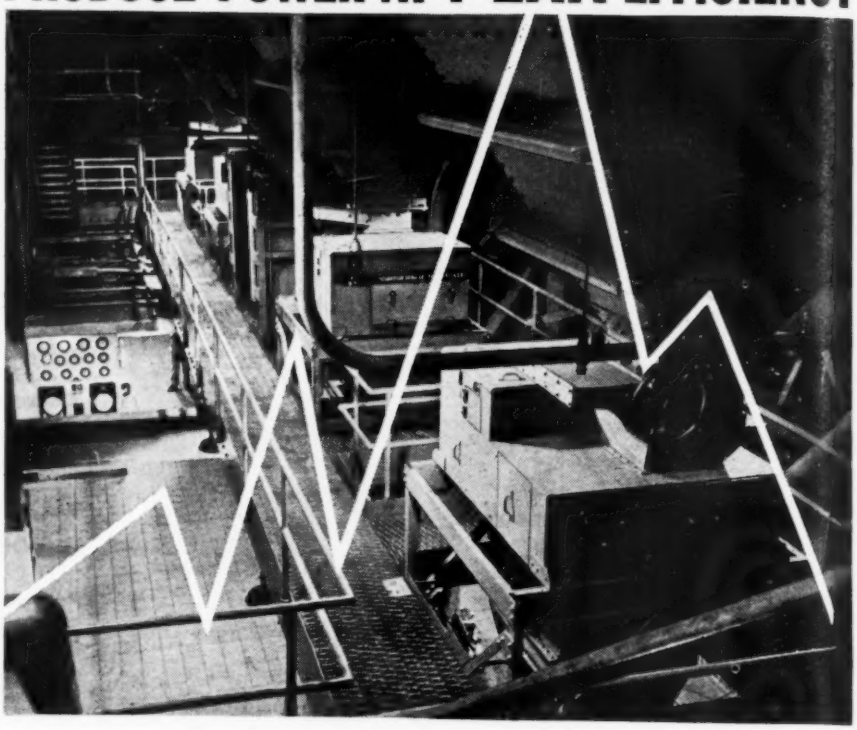
5 The Rotary Valve Seat is attached directly to float stem; one moving element.

6 Upon taking off cover, the float and attached valve lift out at once.

Write today for further particulars

COCHRANE CORPORATION
A DIVISION OF AMERICAN ENGINEERING COMPANY
3106 N. 17th St., Philadelphia 32, Pa.

PRODUCE POWER AT PEAK EFFICIENCY



With the aid of RICHARDSON COAL SCALES

One of the first steps in the task of producing power at peak efficiency is recording coal consumption . . . and one proved way of doing this is with the Richardson Coal Weighing and Feeding System.

A Richardson Scale placed over each boiler will give you comparative records of coal consumed. Automatically, accurately and continuously, the Richardson Scale will keep an exact record of coal burned per hour, day, week or year.

Illustrated, are four waist-mounted Richardson Automatic Scales weighing coal from bunkers and discharging it through downspout to pulverizers. The extensive Richardson line of equipment for weighing, conveying and feeding coal includes the model that is ideally suited to *your* space, layout and capacity requirements . . . stationary floor-mounted models, stationary and portable models mounted at mid-section, and combination Conveyor and elongated Scale. The Richardson is the scale that will help you to operate your power plant at peak efficiency. Write for Bulletin No. 1143.

305

RICHARDSON SCALE CO.
CLIFTON, N. J.
Atlanta • Boston • Chicago • Omaha • Montreal • New York • Philadelphia
Minneapolis • Detroit • San Francisco • Toronto • Wichita • Pittsburgh

performance measured in Millionths

In more than 40 Army and Navy applications, American Bosch Diesel Fuel Injection Equipment is at work today on the tasks of war. Ships of all kinds, tanks, armored cars, bulldozers, and stationary Diesels for many power uses are included in the impressive list.

In American Bosch Fuel Injection Pumps, tolerances are often measured in millionths of an inch . . . thirty-nine millionths, for instance, between the cylinder wall and the plunger of the pump.

In the picture, an American Bosch craftsman is performing a vital grinding operation on the plunger. This is just one of the several critical operations on this same part . . . critical because the accurate metering of fuel is involved.

Such craftsmanship is traditional at American Bosch. Teamed with engineering experience which guides it, it continues to draw most of the nation's Diesel engine builders to Springfield for their fuel injection requirements.

AMERICAN BOSCH CORPORATION
Springfield 7, Massachusetts

AMERICAN BOSCH

AUTOMOTIVE AND AVIATION ELECTRICAL PRODUCTS • FUEL INJECTION EQUIPMENT

Brush Away Refractory Troubles

SAVERITE REFRACTORY COATING

Applied with brush. Binds old cracks and loosened brickwork. Prolongs life of old, wornout refractories.

FILL OUT AND MAIL

SAVERITE ENGINEERING COMPANY

1030 Willow Ave., Hoboken 3, N. J.

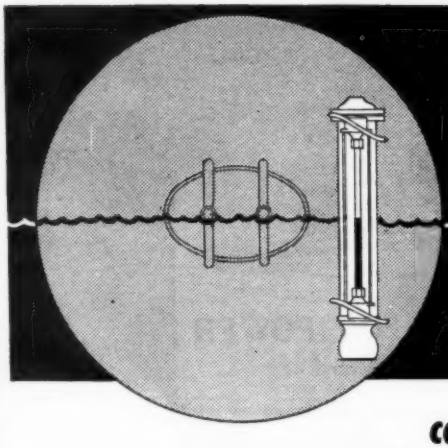
Send details of Saverite Refractory Coating to

Name .....

Position .....

Company .....

Address .....



The CORRECT WATER LEVEL *for your* BOILERS

can be maintained

CONTINUOUSLY, AUTOMATICALLY, ACCURATELY

under* ALL LOAD CONDITIONS *with

HENSZEY *Boiler Feed* REGULATORS

The Henszey Regulator is easily installed right in the feed line — no additional structural supports are needed. Once installed and set for operation, no further attention is necessary — nothing to get out of order — nothing to rust.

Avoid the hazards of high, as well as low water levels — plan now for positive, accurate boiler water level control . . . investigate Henszey Boiler Feed Regulators.

HENSZEY CO. Dept. D8 **Watertown, Wis.**

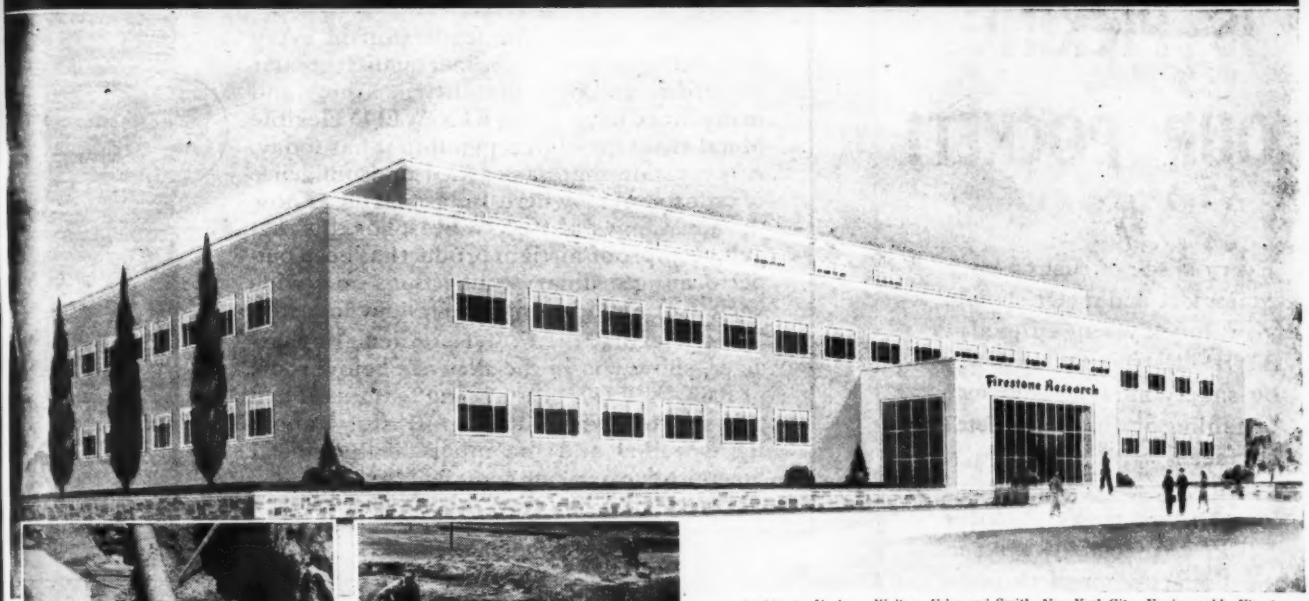
The Henszey Boiler Feed Regulator is made for pressures up to 600 pounds and in pipe sizes up to four inches.

HENSZEY

BOILER FEED REGULATORS

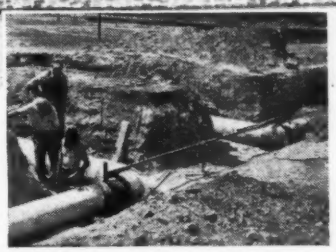
Continuous Blowdown • Distillation Systems • Heat Exchangers
Feed Water Meters • Flow Indicators • Proportioning Valves

RIC-WIL STEAM CONDUIT CONNECTS NEW Firestone RESEARCH LABORATORY TO CENTRAL BOILER PLANT ONE MILE AWAY

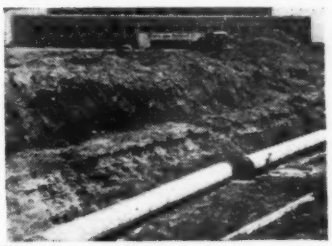


Architects, Vorhees, Walker, Foley and Smith, New York City. Engineered by Firestone.

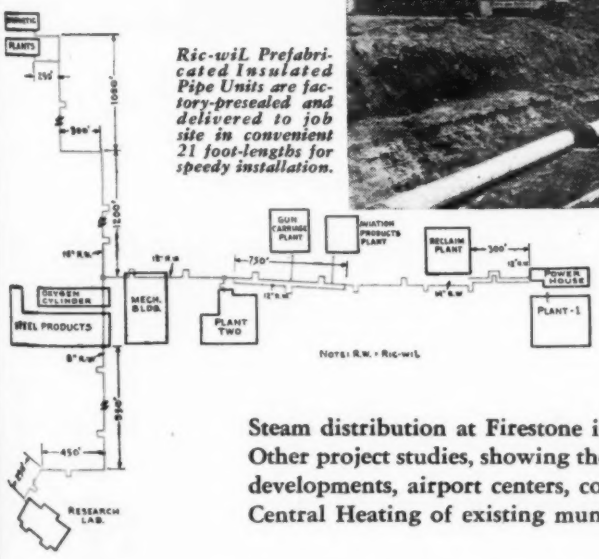
Installing Ric-wiL Prefabricated Insulated Conduit on steam line to Firestone Laboratory. Note pipe and casing anchored at 45° offset.



Ric-wiL Prefabricated Expansion Loop "cold sprung" into position. Loops are fitted with drive couplers for easy assembly to straight runs.



Ric-wiL Prefabricated Insulated Pipe Units are factory-presealed and delivered to job site in convenient 21 foot-lengths for speedy installation.



The very latest developments in building design and services have been incorporated in the magnificent new Firestone Research laboratory. The objective was to provide the utmost in comfort for the chemists, physicists, engineers and technicians, and to supply those many services required in research work.

After an exhaustive study, it was determined that instead of a boiler plant at the site, it would be more practical to extend a steam line from the nearest factory building 2100 feet away, and thus obtain heat and power from the main power plant over a mile to the north. Steam is delivered to the laboratory in 8" Ric-wiL Prefabricated Insulated Pipe, at 180 P.S.I.

Every building in the vast Firestone Akron industrial community obtains its steam from one central plant. Schematic plot plan at left shows distribution lines—practically all of which are now in Ric-wiL Prefabricated Insulated Pipe Conduit.

Steam distribution at Firestone is described in detail in a booklet now in preparation. Other project studies, showing the application of Central Heating to community housing developments, airport centers, commercial groups, shopping centers and conversion to Central Heating of existing municipalities or neighborhoods, are available on request.

RIC-WIL INSULATED PIPE CONDUIT SYSTEMS
THE RIC-WIL COMPANY · CLEVELAND, OHIO
AGENTS IN PRINCIPAL CITIES

RUST IS PICKING YOUR POCKET!

Every speck of rust on your equipment and material costs you money—needlessly! STOP destructive corrosion by simply spraying, dipping, brushing or flushing metal surfaces with Tectyl—it *seals* out moisture for as long as two years. *Not a Paint!* You can always see the protected metal through its thin transparent film. A little Tectyl covers a lot of metal, and comes off quick and clean with kerosene. Let us help you revise your pre-war rust prevention practices in the light of war experience.

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Product for every rust problem

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TECTYL

STOPS RUST

REX-WELD

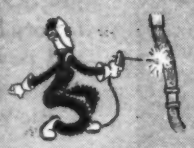
KING OF FLEXIBLE METAL HOSE!

There are reasons for leadership in every line. Better performance, finer quality, greater versatility and dependability . . . these and many more have given REX-WELD Flexible Metal Hose the high reputation it has today. A reputation that has earned the confidence of industry everywhere. Industrial men know the advantages of REX-WELD. For this rugged, seep-proof, airtight product has been outperforming ordinary connections on a wide variety of applications throughout industry.

Let "Flexon," the C. M. H. trademark character, show you in the sketches below some of REX-WELD'S outstanding features. Then ask us to give you the full story about REX-WELD and the other flexible metal hose products in our complete line.

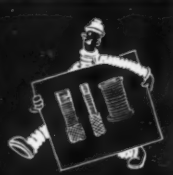
REX-WELD . . . stands up under terrific flexation, vibration and strain. Its heavier, more uniform wall structure gives it greater strength, longer life.

REX-WELD . . . handles steam with utmost safety. It is seep-proof to gas, oil, water and searching fluids. It is highly rust-resistant and non-deteriorating.



REX-WELD . . . operates efficiently under pressures up to 5,000 p.s.i., temperatures to 1000° F. Greater strength and durability are the result of its 50-50 principle of corrugation . . . of an autogenous welding process that makes the weld stronger than the tube itself.

REX-WELD . . . is available in bronze and steel in sizes from 3/16-in. to 4-in. I.D. (incl.), with annular or helical corrugations, braided or unbraided, depending on requirements. REX-TITE heatproof mechanical couplings are easy to install and are reusable.



Flexible Metal Hose for Every Industrial Use

ARMY E NAVY

CHICAGO METAL HOSE CORPORATION

MAYWOOD, ILLINOIS

Plants: Maywood and Elgin, Ill.

SAYS THE MAN IN THE HELMET—
"My first choice for any welding job is one of these swell
AIRCO ELECTRODES.
They're easy to use and they do a grand job."
AIRCO
ELECTRODES

THAT in brief is the reason why so many welders prefer Airco Electrodes for every welding job. For, in addition to meeting the metallurgical and mechanical requirements of each specific job, Airco Electrodes have those easy-working features that enable the welding operator to meet output schedules consistently.

After exacting laboratory trials each new Airco electrode is thoroughly pretested for working ease and efficiency by welding operators of varying skill and experience. Their suggestions, incorporated into the final product, assure an electrode that will rate high with the vast majority of operators.

* * *

SEND FOR FREE CATALOG

—which gives detailed information on Airco's complete line of shielded arc electrodes for every welding job. Address your local Airco office or Dept. P, Air Reduction, General Offices: 60 East 42nd Street, New York 17, N. Y. In Texas: Magnolia Airco Gas Products Co., General Offices: Houston 1, Texas.

AIR REDUCTION AIRCO

OFFICES IN PRINCIPAL CITIES

Weld with

AIRCO ELECTRODES FOR BETTER WELDS AND EASIER WELDING

Proved power and endurance for cleaning small tubes

The Roto Company
Newark, N. J.

Gentlemen:

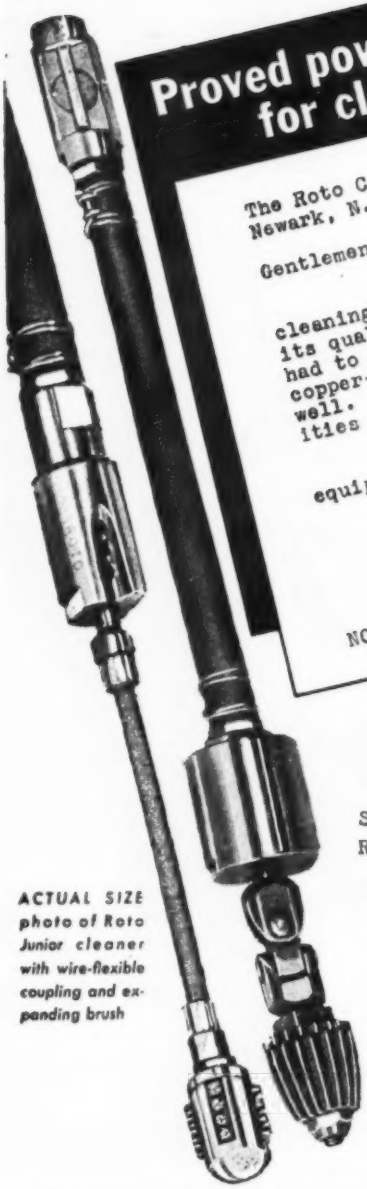
On receipt of your miniature tube cleaning equipment, I was a bit dubious of its qualifications to carry out the job it had to do. It has cleaned 4,000 3/4"x 24' copper-nickel tubes, and has done this job well. All suspicions of its staying qualities have been removed.

I can heartily recommend this equipment. Thanking you.

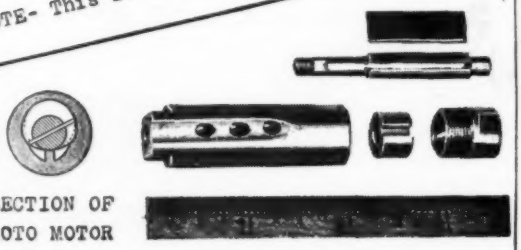
Yours respectfully,

(Signed) Chief Engineer
(Large municipal power plant)

NOTE- This is unsolicited



ACTUAL SIZE photo of Roto Junior cleaner with wire-flexible coupling and expanding brush



SECTION OF ROTO MOTOR

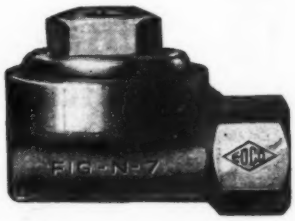
The Secret of the power and endurance of the Roto Junior Tube Cleaner is its extreme simplicity of design and precision construction. It has only two moving parts, a shaft and a solid blade. Positive contact between the blade and the Rotocentric bore cylinder assure an undivided air stream and freedom from leakage. Its convenient size, speed and ease of operation, offer a marked contrast with old type, cumbersome external cleaners. Send for details.

ROTO Junior Tube Cleaners

ROTO Division of Elliott Company 145 Sussex Ave., Newark , N. J.

EDCO

SPRAY NOZZLES



for RE-COOLING AND AIR CONDITIONING

Any industrial atomizing —cooling—or washing operations that call for spray nozzles can be done *better* with Edco.

Here's why: every EDCO tip is carefully designed and checked for spray angle, atomization and actual rated capacity — goes through rigid inspection before the EDCO diamond is stamped on it.

EDCO *is furnished in*

STAINLESS STEEL
BRONZE
NITRALLOY
MONEL
STONEWARE
HARD RUBBER

For savings offered by EDCO write at once for Booklet 2046.

EDDINGTON METAL SPECIALTY CO.

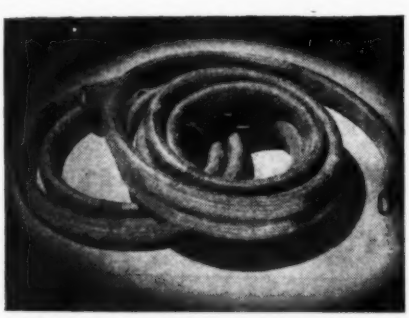
P. O. Box K Eddington, Pa.

EUREKA OVAL GUM CORE

the all-round packing for general use

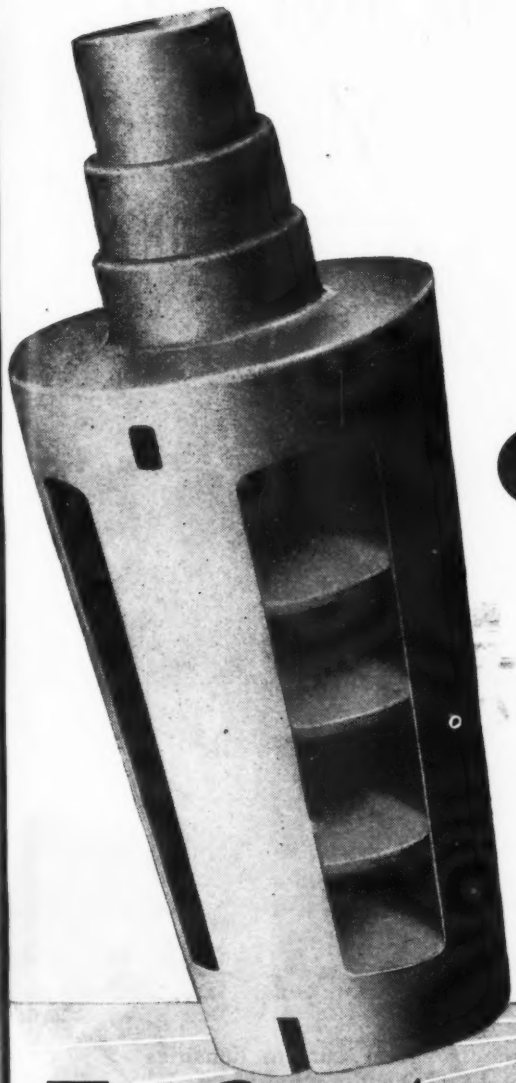
Except for high pressure steam, OVAL GUM CORE is recommended for all classes of service and can be depended on to give longer and better service.
EUREKA OVAL GUM CORE is made of high quality black rubber core over which is braided imported EUREKA yarn thoroughly lubricated by a special process. Made OVAL in sizes from 3/16" to 2". A trial will prove its effectiveness and economy.

"EUREKA"



Trial sample available on request. Send for the EUREKA 36-page catalog covering complete packing line.

EUREKA PACKING CO., 294-296 46th St., Brooklyn 20, N. Y.



Outstanding Castings...

...For Stand-out Service

Experience and skill—36 casting-years of it—*plus* the latest in scientific testing and control . . . all are combined at Sivyer to give you higher steel casting quality—for longer, trouble-free service.

Long before a Sivyer casting takes material form—this skill is at work for you . . . in the careful study of pattern design . . . the thorough beforehand planning . . . the engineering.

And when metal is poured, Sivyer's casting methodology—based on this long experience—is there to assure steel castings of greater internal integrity. Later, careful inspections and numerous tests further establish the right of every steel casting to wear the Sivyer diamond ◈ — *the mark well worth looking for.*

SIVYER STEEL CASTINGS

CASTING COMPANY
MILWAUKEE CHICAGO

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C. H. WHEELER
OF PHILADELPHIA

STEAM CONDENSERS

•

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MANUFACTURING Co.
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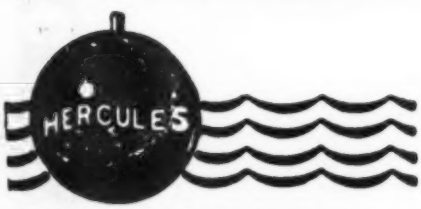
HERCULES
Seamless Copper
FLOATS



GUARANTEED
TO STAND UP!

Every Hercules Float carries our guarantee to stand up under 350 lbs. working pressure and 500 degrees temperautre.

Fabricated of seamless copper under our special spinning process. Hercules Floats are uniform in thickness and high in mechanical strength.

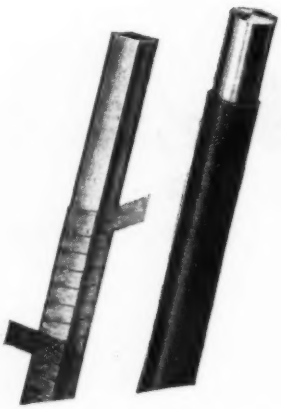
You can depend on Hercules for floats—in standard shapes up to 10 in. and in special types to your specifications—to give long, dependable, economical service.

Insure care-free maintenance of water level in your heaters, tanks, reservoirs and other equipment by specifying "HERCULES."

HERCULES FLOAT WORKS
200 Franklin St.
SPRINGFIELD, MASS.

A TOUGH, HOT JOB FOR MAGNET WIRE

CALLS FOR DELTABESTON



This massive skull cracker ball weighs 8400 lbs. Suspended by a 55-inch magnet, it is ready to drop and crush machine cast scrap to cupola charging size.

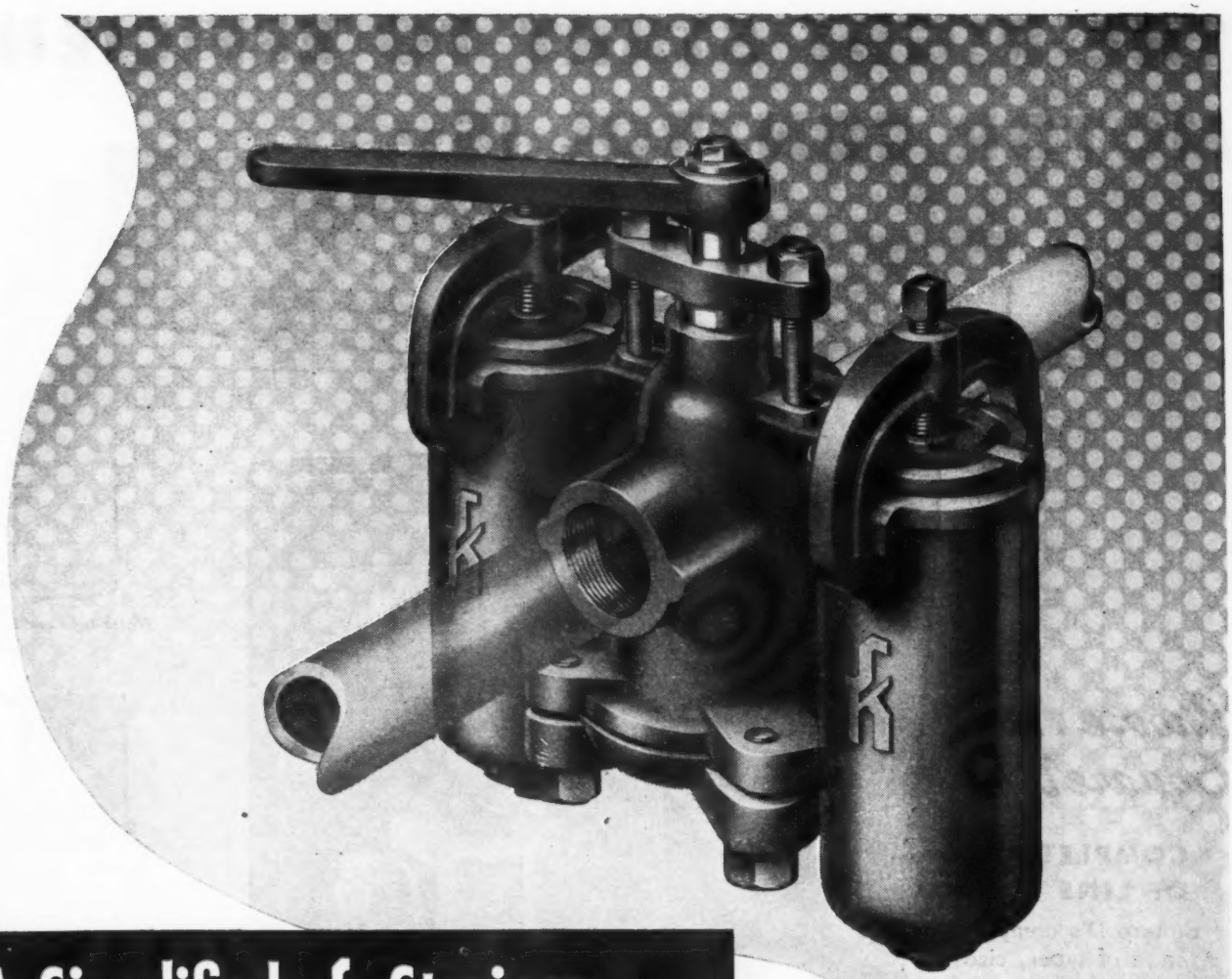
SUCH applications require great current densities and generate high heat. That's why industrial plants protect their electrical equipment with Deltabeston Asbestos-insulated or Deltaglass Magnet Wires. Despite severe operating conditions of high conductor heat and extreme weathering, the varnished asbestos or glass insulation remains unimpaired.

Deltabeston and Deltaglass are ideal for safeguarding motors against high ambient temperatures and overload heat because the impregnated asbestos or varnished glass yarn insulations just won't bake out. These heat-resistant magnet wires are used extensively for winding armatures, field coils, stator windings, magnetic brakes, welding equipment, lifting magnets, industrial controls and solenoids. Both Deltabeston and Deltaglass are available in round, square and rectangular shapes covering a complete range of sizes.

Do you have a magnet wire problem where heat or moisture prevail? You can obtain additional information by writing to Section Y854-52, Appliance and Merchandise Dept., General Electric Co., Bridgeport, Conn. All Deltabeston Asbestos, Glass and synthetic wires are sold by Graybar Electric Company, G-E Supply Corp. and other G-E Merchandise Distributors.

GENERAL ELECTRIC

BUY WAR BONDS AND KEEP THEM



A Simplified SK Strainer . . .

designed to give you more for your money

Here is a duplex strainer which does a thorough job of removing dirt and other foreign matter from oil, water and other liquids, *yet is moderately priced.* Design simplifications, standardization and construction economies all contribute to making this new strainer outstanding in many ways.

Check These Features:

DUPLEX DESIGN—

permits each strainer to be cleaned without flow interruption.

ONLY 1 VALVE—

single shut off cock with double-port provides continuous flow during switch-over and is pressure balanced for easy operation. Steel spring takes up any plug wear and insures against leakage.

VERTICAL BASKETS—

allow continuous flow while cleaning. Dirt is collected in the basket which is easily removed without loss of fluid. Strainer free area is a minimum of 5 times pipe area.

SINGLE-SETSCREW CLAMPS—

quickly removable, yet seal basket chambers tightly.

PACKING GLANDS—

nut-and-stud type, easy to adjust and will not corrode and "freeze."

PLUG DRAINS—

on basket chambers for draining fluid from unit.

Made of cast bronze, these SK Duplex Strainers are designed for pressures up to 125 psi, in pipe sizes from ½ to 2 inches. Being light-weight, they need no support other than the pipe line.

Other SK Strainers are made in cast iron for pressures up to 250 psi or steel for pressures up to 600 psi and sizes up to 6 inches.

JET APPARATUS • CONDENSERS AND VACUUM PUMPS • HEAT TRANSFER EQUIPMENT
VALVES • ROTAMETERS • FLOW INDICATORS • GEAR PUMPS • STRAINERS
OIL BURNING EQUIPMENT • SPRAY NOZZLES AND ATOMIZERS • RADIAFIN TUBES

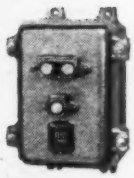
SCHUTTE & KOERTING CO.

Manufacturing Engineers

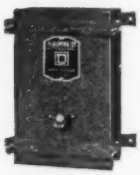
1150 Thompson Street, Philadelphia 22, Pa.

THE RIGHT START TO EFFICIENT MOTOR CONTROL IS—

the Right Starter



Water-tight enclosure



Dust-tight enclosure

Class 8538 Combination Starter

Choose... Square D for

• COMPLETENESS OF LINE

Square D's complete range of types, sizes and enclosures enables you to select exactly the right starter for each job. Manual, Automatic, Line-voltage, Reduced-voltage, Reversing, Multi-speed.

• SIMPLICITY OF DESIGN

Square D starters are simply designed and ruggedly built to give long life under severe operating conditions. Although compact, the ample wiring space and accessible terminals reduce installation time.

• EASY, FAST MAINTENANCE

Accessibility simplifies inspection and saves valuable production time should replacements be necessary. Contacts can be quickly changed without disturbing external connections.

• When you select Square D starters, you can be confident that they'll back up your judgment in terms of consistent, efficient service. That they are designed and built to "take it" is being doubly proved by their around-the-clock wartime performance in thousands of America's leading industrial plants.

• See your nearby Square D Field Engineer for details or write for Bulletin 8536 (Line-Voltage Starters) or Bulletin 8538 (Combination Starters). Square D Company, Industrial Controller Division, 4041 North Richards St., Milwaukee 12, Wis.

SQUARE D COMPANY

DETROIT • MILWAUKEE • LOS ANGELES

Imagine! Being able to eat lunch on the floor over the bunkers!

IF YOU WERE ASKED to name the dirtiest part of a power house, in all probability you would mention the floor over the bunkers.

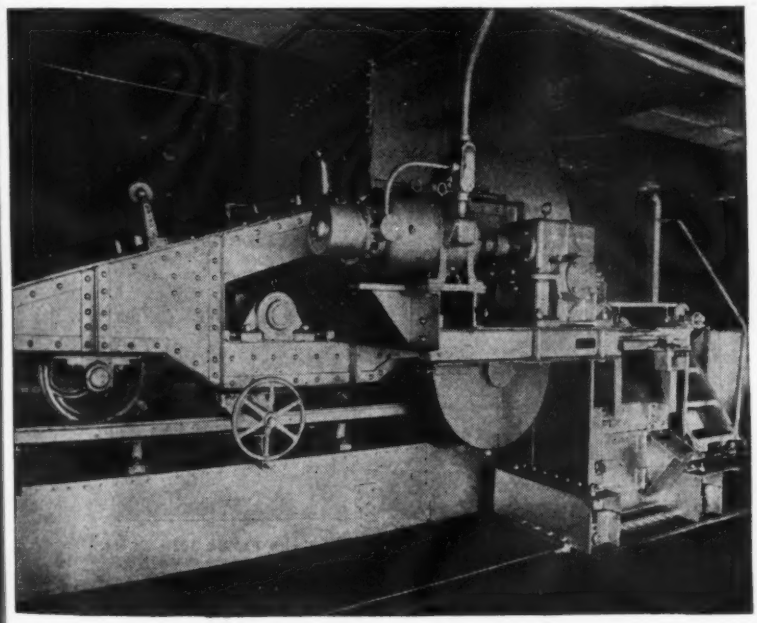
Yet, in one midwestern central station, you could actually sit down and enjoy a tasty lunch in that very place.

When this station was being designed, it was determined that the plant must be spotless—in spite of the fact that it was to be fueled with coal. Robins was given the assignment of designing Conveyors and Trippers that would be dust-tight.

The Conveyors were more or less easy. There is scarcely any kind of Belt Conveyor that Robins has not designed since the time, over half a century ago, when Mr. Thomas Robins first conceived the rubber-covered Belt and the trough-shaped Idler.

A dust-tight Tripper, however, was an entirely different problem. There was no such thing, up to then. But there is now. It is protected by everything including patents. Not a speck of dust escapes when the coal passes from the Belt to the bunkers below. The room can be kept as clean as any dairy.

Fortunately, the additional cost for a Robins Dust-tight Tripper is moderate—well within the means of any plant wanting modern methods and sanitary surroundings. Fortunately, too, you can have as much or as little of the dust-tight qualities as you may want in a Conveyor System. Robins has designed them in all stages—from having this feature only on the floor over the bunkers, to complete dust-tightness from car unloading all the way into the stokers.



Whether your materials handling needs are simple or complex; whether you want an entirely new system or a few replacement Idlers—get in touch with Robins. When writing, please address Dept. P-8.

ENGINEERS, MANUFACTURERS AND ERECTORS OF MATERIALS HANDLING MACHINERY

ROBINS *makes:* BELT CONVEYORS · COAL AND ORE BRIDGES · BUCKET ELEVATORS · CAR AND BARGE HAULS · CAR DUMPERS · CAR RETARDERS · CASTINGS · CHUTES · CONVEYOR IDLERS AND PULLEYS · CRUSHERS · FEEDERS · FOUNDRY SHAKEOUTS · GATES · GEARS · GRAB BUCKETS · PIVOTED BUCKET CONVEYORS · VIBRATING SCREENS · SCREEN CLOTH · SELF-UNLOADING BOAT MECHANISMS · SKIP HOISTS · STORAGE AND RECLAIMING MACHINES AND SYSTEMS · TAKEUPS · LOADING AND UNLOADING TOWERS · TRIPPERS · WEIGH LARRIES · WINCHES · WINDLASSES

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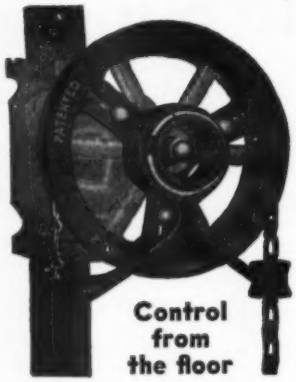

With the Babbitt Rim for Valves you eliminate danger and banish the step ladder. You can now place your valves wherever they come economically and conveniently. They fit any valve. Let us tell you more about them. Write today.

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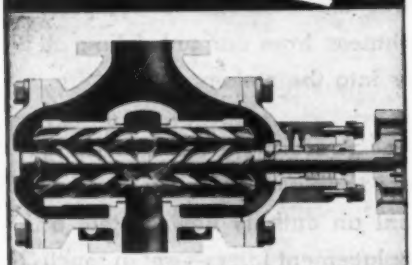

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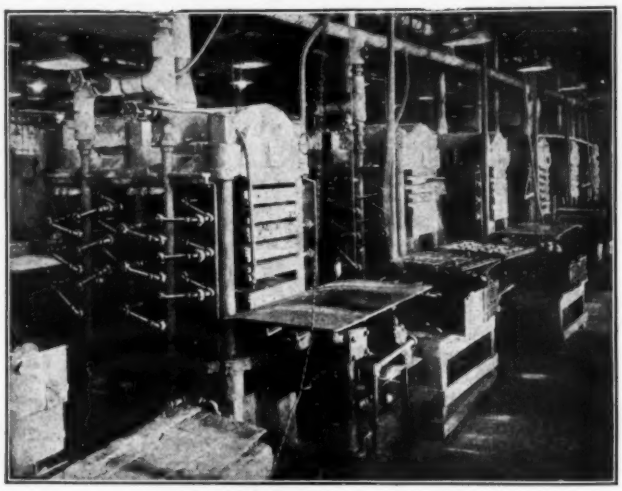

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are really trouble proof as there are no springs or little parts to lose or ground surfaces to wear. All moving parts are entirely enclosed and fully protected from dirt and grit. They will give you indefinite service at low—extremely low—maintenance cost. Use them wherever a flexible or swing pipe joint is required for handling steam, compressed air, hot or cold water, gas or other fluids, they will save you money, trouble and time.

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All pressures to 1350 lbs. superheated steam
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—ORIGINATORS OF SNUBBING PRINCIPLE FOR QUIETING DIESEL EXHAUSTS—BURGESS—ORIGIN

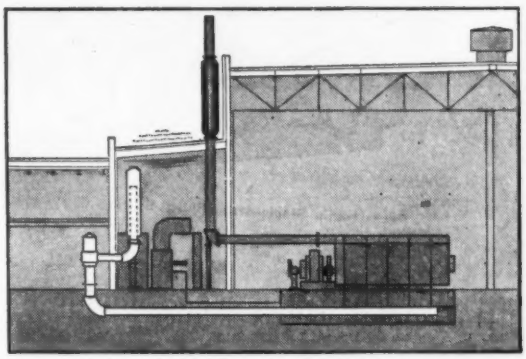
BURGESS SNUBBER BULLETIN for Diesel Exhaust Noise Control

PROPER SNUBBER POSITIONING IS IMPORTANT IN AIR INTAKE SYSTEMS

These Burgess Snubber Bulletins have, in the past, emphasized the importance of installing the Snubber in the correct position in the air intake system. For best results, the Snubber should be located near the compressor, although considerable reduction in intake surges can sometimes be attained if the Snubber is installed farther from compressor.

An interesting intake problem was created by a battery of 50 Diesel-driven reciprocating compressors in a war plant, which were installed 25 to a building. In the original installation the 20-inch intake pipe of each compressor was extended underground and brought outdoors 70 feet from the compressor. Later, the inlets were brought indoors into an adjoining low-roofed portion of the building to promote better ventilation in the engine room. With 25 compressors operating in one building, all with indoor intakes, the resulting air pulsations caused a serious roof displacement of the low-roofed section. At this point, a Burgess-Manning engineer was invited to make manometric tests and to suggest changes which would reduce the objectionable pulsations within the building.

There was no opportunity to gain access to the intake piping, most of which was buried below the concrete floor. Therefore, the only spot at which a Burgess Intake Snubber could be installed experimentally was at the inlet 70 feet from the compressor which was recognized to be a serious handicap.

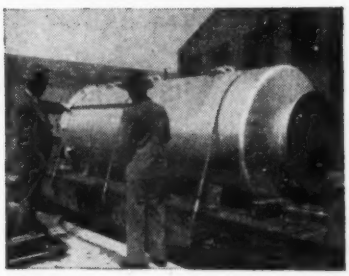


Plant diagram showing location of intake and exhaust system. Pressure surges cause roof over intake pipe to vibrate excessively.

In spite of its poor location, the Burgess Snubber reduced the surge amplitude by 60%, which, considering the small size of the building, was a marked improvement. Other local structural features, however, prevented a more comprehensive solution to this problem. The moral of this story is that the design of quiet, pulsation-free compressor intake systems is a critical engineering job and one in which Burgess-Manning engineers can give valuable advice to industrial engineers and architects. This case study also illustrates how difficult it is to undo engineering errors especially when large engines or compressors are involved.

* * *

HOW BIG IS A SNUBBER?



Burgess Snubbers vary in size from a small unit a foot and a half long to the massive 40-inch unit shown above on the flatcar. Regardless of size, the structural details of all Burgess Snubbers are alike and they all perform the same duty . . . effectively to quiet the exhaust or intake of all types of internal combustion engines, compressors, and blowers.

Standard Burgess Snubbers are available for exhaust or intake stack pipes up to 32 inches in diameter, and therefore provide suitable snubbing for all engine application.

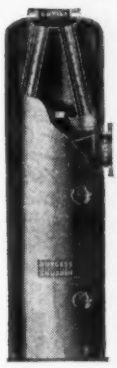
There are many baffling engine intake and exhaust problems. For a specialized service in this field call upon Burgess engineers. Their experience in the application of gas laws and thermodynamics is valuable in developing highly efficient exhaust or intake systems.

BOOKLET "STORY OF SOUND" AVAILABLE

It is not too late to obtain your free copy of the new Burgess-Manning booklet, "A Story of Sound." Persons interested in the phenomena of sound and in the latest developments in noise abatement and sound control will want to read this booklet.

Send your request today for a copy of "A Story of Sound." Our supply is limited.

BURGESS SIDE INLET EXHAUST SNUBBER STL SERIES



With the Burgess STL Series side inlet Exhaust Snubber, the exhaust gases enter the side of the Snubber and pass out of the top. It is used on industrial engine installations which require a 10-inch or larger exhaust Snubber.

The Burgess side inlet Snubber is suited for large engines with overhead exhaust pipes. A flange provided on the base of the Snubber eliminates the need for special support brackets. This Exhaust Snubber will operate with equal efficiency whether it is located close to or far away from the engine.

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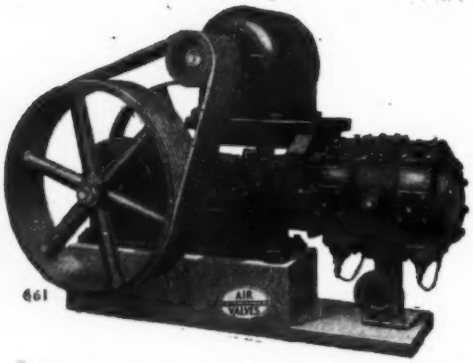
PLETE SATISFACTION IN EXHAUST AND INTAKE QUIETING—SPECIFY BURGESS SNUBBERS—FOR COM



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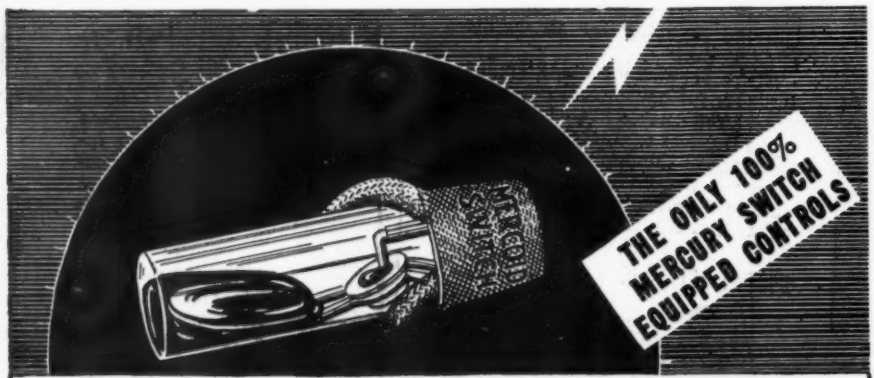

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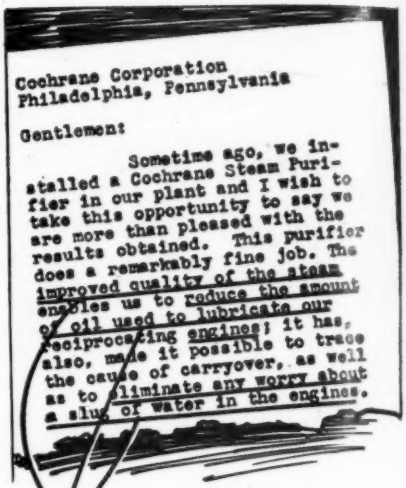

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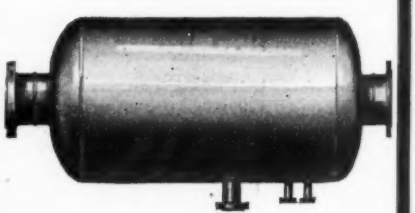
Sometime ago, we installed a Cochrane Steam Purifier in our plant and I wish to take this opportunity to say we are more than pleased with the results obtained. This purifier does a remarkably fine job. The improved quality of the steam enables us to reduce the amount of oil used to lubricate our reciprocating engines; it has, also, made it possible to trace the cause of carryover, as well as to eliminate any worry about a slug of water in the engines.

improved quality of steam

less oil to lubricate engines

eliminates worry over slugs of water in engines.

COCHRANE



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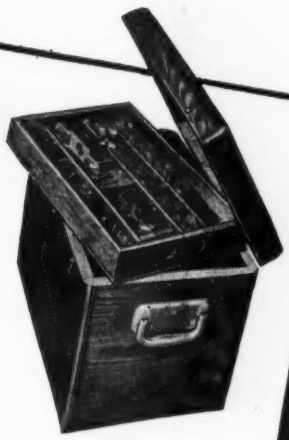
AS STEAMFITTER, I'M THE ONE WHO USES

DEXTER VALVE RESEATING MACHINES AND CUTTERS



We don't have extra helpers around the plant these days. Every man has more than enough work ahead of him. That's one big reason why we're so happy with our new Dexter Valve Reseating equipment.

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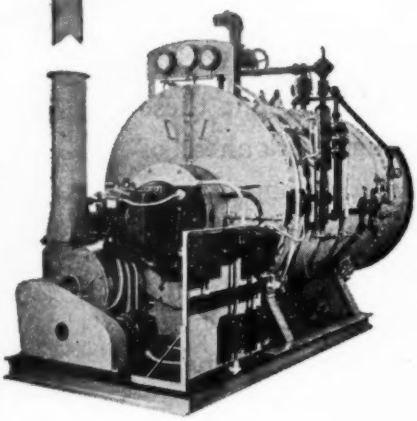

that induced draft eliminates the very real danger of forcing the products of combustion into the boiler room

that exactly the right amount of air could be admitted into the furnace space for complete combustion

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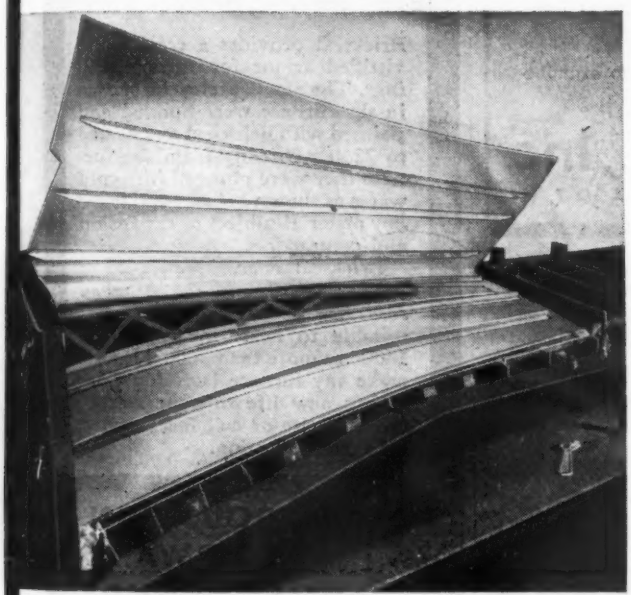
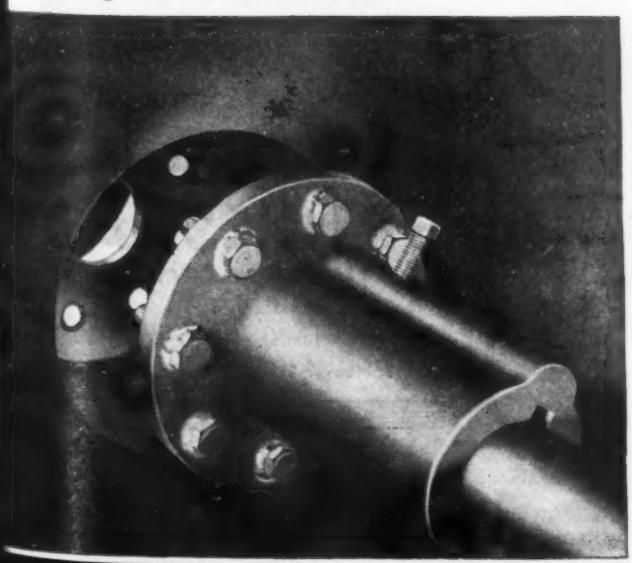


JIG FORMED for strict uniformity, blades are shaped from a single heavy wrought monel sheet with the trailing edge electric-welded. Note the welded-in "wing spar" and stiffening webs for staunch rigidity and endurance.

HUB SLEEVE on fan shaft provides key and set screw locking, yet permits removal of the fan assembly without driving the sleeve off the fan shaft.



Here are a few of the reasons why Pritchard FEATHERWEIGHT Fans are acclaimed by operators as the optimum answer to cooling tower fan problems:

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5. ADJUSTABLE BLADE PITCH permits selection of most desirable setting for any tower loading.
6. HUB SLEEVE (see lower left) permits easy removal of fan for winter operation and also makes quick work of removing the gear unit for servicing.

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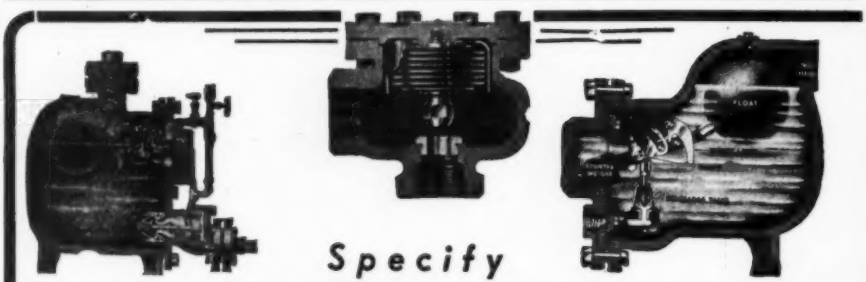

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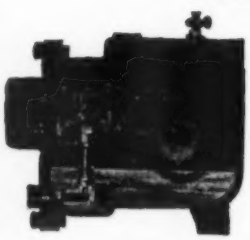

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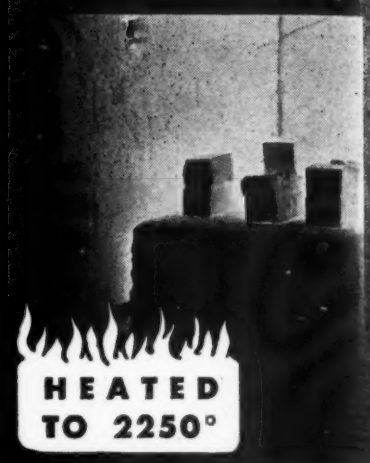

Brickseal provides a crackproof, vitrified armor for furnace linings. The small firebricks shown in the furnace were bonded and painted with Brickseal and heated to 2250°. Directly from the furnace they were plunged into cold water as shown below—a test for *any* material subject to expansion and contraction.

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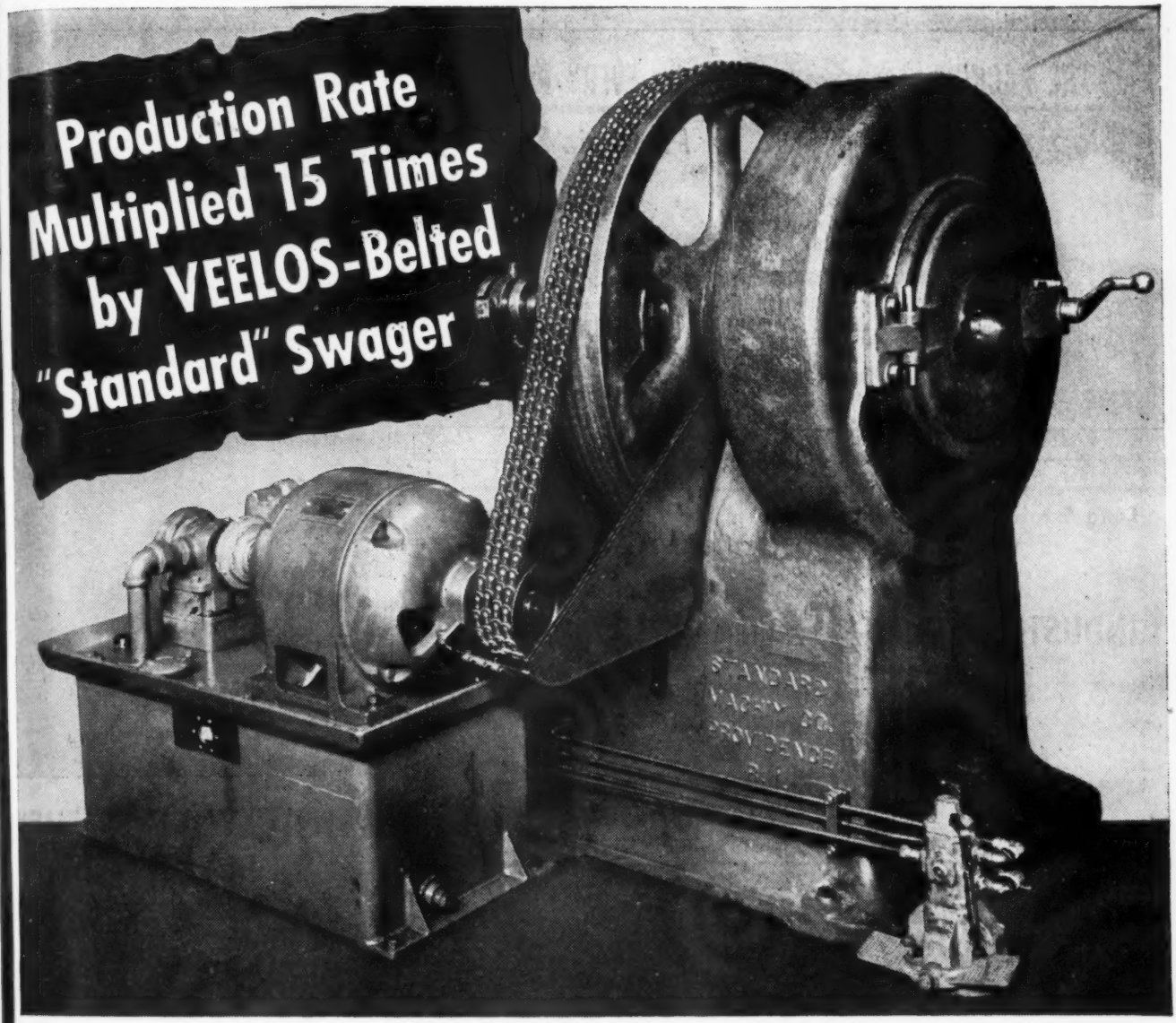

THE NAVY needed a swager that would attach aircraft fittings to steel cables at record breaking speed. Standard Machinery Company, of Providence, designed this improved model that has increased the former established production rate as much as 15 times.

It's significant that the V-belt chosen for this high-speed swager is Veelos—the adjustable V-belt. For Standard required a drive that delivered power smoothly . . . that promoted continuous machine production . . . a drive with the following advantages of Veelos:

1. Smooth Power Delivery: Easy adjustment of Veelos length assures that each strand of a multiple V-belt will carry its exact share of the load. All strands constantly work together, *delivering full power with minimum vibration.*

2. Quick Adjustment: With Veelos in rolls, V-belts can be replaced in a few minutes . . . maintaining machine production . . . reducing machine downtime.

Perhaps these same Veelos advantages that appealed to Standard are of special interest to you. Or perhaps you will find others among the 12 major Veelos production advantages more important to you. It will pay to know! Write today for *free 8-page illustrated manual* giving Veelos applications, construction detail, installation directions and engineering data.

VEELOS
THE LINK
V-BELT
Adjustable to any Length
Adaptable to any Drive

MANHEIM MANUFACTURING & BELTING CO., MANHEIM, PA.

Link Construction Ups Production

THE PACKING for EVERY PURPOSE

Stops Leaks— *Prevents Scoring*

ALLPAX

This universal packing—consisting of long, tough fibrous asbestos fibres, thin flakes of anti-friction metal, minute graphite scales and a heat-proof lubricant—is recommended for general service against steam, water, air, ammonia, oils, gases, etc. where temperatures do not exceed 600°F. Fits all sizes and shapes of stuffing boxes. Special styles available for high temperature and corrosive liquids, for products, etc. Try it and you'll use it regularly.

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including these features

1. Review of new power equipment, materials and supplies.
2. Report on power papers at the ASME annual meeting.
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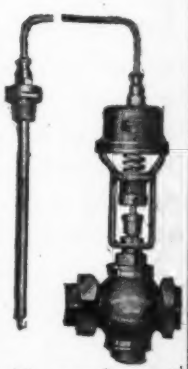
DON'T WASTE FUEL

Save it with

ATLAS

Temperature Regulators



It's both sensible and patriotic to see that only the exact amount of heat needed goes into your liquids in open or closed tanks, heaters, etc.

The ATLAS Type 650, pictured at the right, comes in sizes ½" to 2½". Easy to install and adjust. Both bulb and control valve operate in vertical or horizontal position. Equipped with seamless metal bellows. Suitable for use with low or high pressure steam.

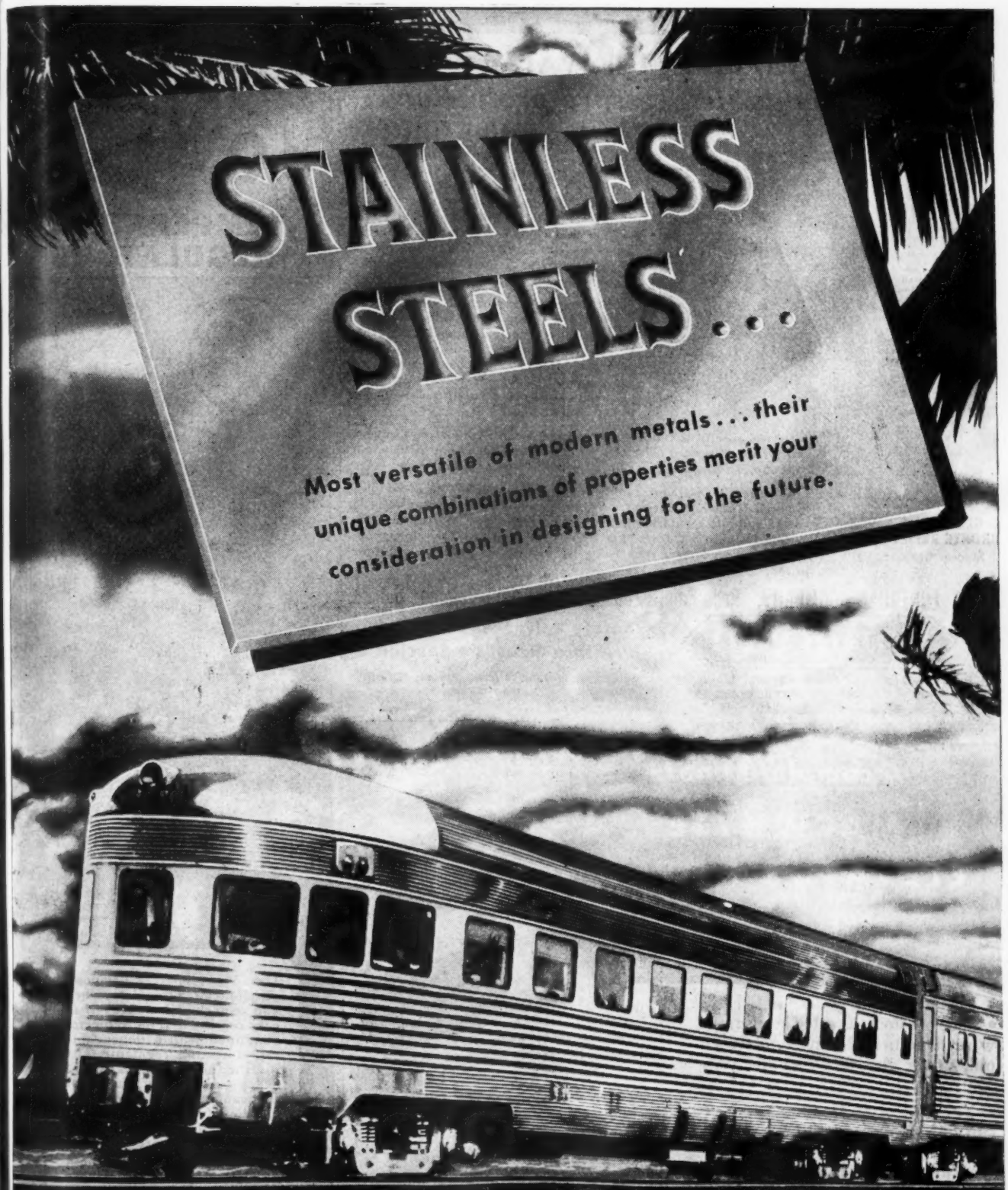
For data on other ATLAS Temperature Regulators see our ad in the Feb. 1945 issue of this journal, or better still, write for Bulletin 7A for complete information.

ATLAS VALVE COMPANY

REGULATING VALVES FOR EVERY SERVICE

289 South St. Newark 5, N. J.

Representatives in Principal Cities


STAINLESS STEELS . . .
Most versatile of modern metals . . . their unique combinations of properties merit your consideration in designing for the future.

● This Streamliner exemplifies the enduring strength and beauty of stainless steel. Characterized by endurance under corrosive conditions, chromium-Nickel stainless steels permit reduction of bulk and dead weight...without sacrifice of strength or safety.

• • •

International Nickel are miners, smelters and refiners of Nickel, an important ingredient of the stainless steels, but do not produce stainless steels. If interested, please communicate with established sources of supply for stainless steels.

THE INTERNATIONAL NICKEL COMPANY, INC. 67 Wall Street New York 5, N.Y.

THESE STURDY RELIEF VALVES
give dependable pressure protection . . . all along the line

Model "R" (VAPOR TYPE) for STEAM, AIR or GAS
Model "RU" (HYDRAULIC TYPE) for LIQUIDS

They look alike . . . but their internal arrangement is different. The Model "R"—designed for line and pressure vessel protection, has a popping chamber and control ring for steam or air service. The "RU" is adapted for use on hydraulic systems, feed water lines, pumps and tanks.

These two compact, sturdily constructed companion valves, provide generous relieving capacity . . . they are suitable for many relief valve applications. The Model "RU" for example, is an effective "snifter" or condensate relief valve for steam engine cylinders.

Do not specify the Model "R" where A.S.M.E. Code requirements call for the approved lever type safety valve. Such applications indicate the use of Lonergan Model "ODP", with cap and lever.

Lonergan
GENERAL PURPOSE BRONZE RELIEF VALVES
Models "R" and "RU"

Lonergan safety and relief valves are available in a complete range of types and sizes—from simple vacuum breakers up to relief valves suitable for 15,000 psi hydraulic pressures. Write for Information Bulletin 507 describing Models "R" and "RU"—or for recommendations and data concerning any safety or relief valve application.

J. E. LONERGAN COMPANY, Race and 2nd Streets, Philadelphia 6, Pa.

Lonergan

Safety Valves • Relief Valves
Pressure Gauges • Specialties

SINCE 1872 — *Makers of Pressure-Safety Appliances for the Power, Mechanical, and Process Industries*

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MACWHYTE ELEVATOR ROPES

PREformed or Non-PREformed

8 x 19 Macwhyte Special Traction Steel, PREformed or Non-PREformed

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• Made of selected, tested steels from wire drawn in Macwhyte's own mill under constant metallurgical control.

Your Elevator Maintenance Man can get safe, dependable, economical Macwhyte Ropes from Macwhyte Distributors and Mill Depots conveniently located throughout the country. Macwhyte's complete line of hoisting, counterweight, compensating, and governor ropes makes it easy to get the correct ropes for your equipment.

Send for this complete listing of Macwhyte Elevator Ropes in handy, vest pocket size. Ask for Elevator Catalog E-9.

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Specify **MACWHYTE ELEVATOR ROPES**
Low-Cost-Per-Car-Mile Ropes correctly designed for your Elevators

Economize WITH POWERS

TEMPERATURE REGULATORS

Use a Powers No. 11 Temperature Indicating Regulator when you want the advantages of an easy-to-read dial thermometer combined with a dependable self-operating regulator. The dial thermometer gives a visual check on the performance of the regulator and makes it easy to adjust for the required operating temperature. Various dials and ranges are available.

Is Easy To Install—because both the thermometer and the regulator operate from the same thermal system—only one tapped opening is required.

Write for Circular 2511

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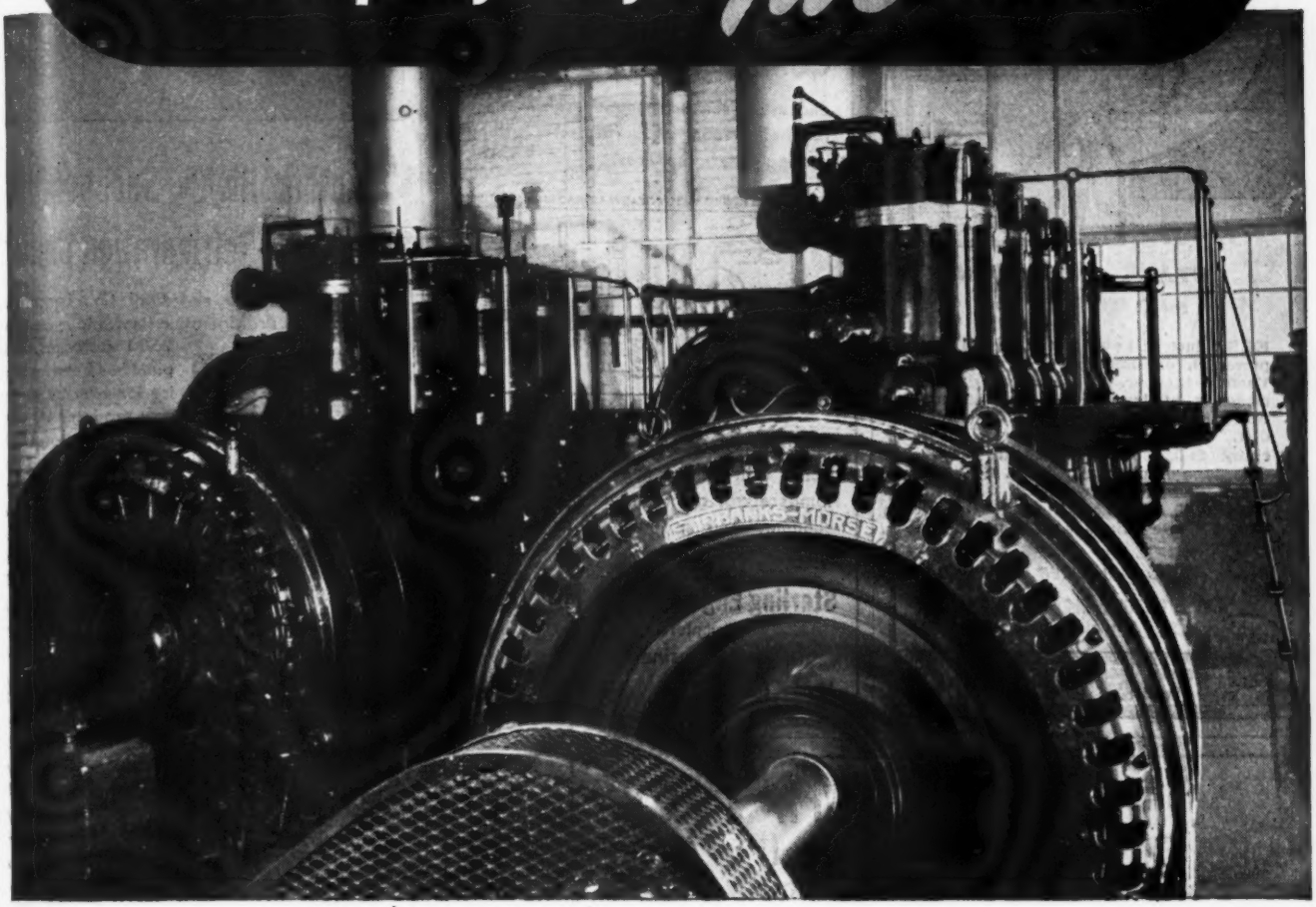
2771 Greenview Avenue, Chicago 14, Illinois
231 E. 46th St., New York 17, N. Y.—Offices In 47 Cities . . . See your phone directory.
70

OVER 50 YEARS
OF AUTOMATIC TEMPERATURE AND HUMIDITY CONTROL

Diesel Demonstrates $3,700 Saving – Company Buys *Two* More!



JUST one year of Diesel operation saved the makers of Valdura heavy-duty maintenance paints $3,700 in plant power costs. So, as expansion plans went into effect, two more Fairbanks-Morse Diesels went into operation.

This is a typical experience. Such performance is built into Fairbanks-Morse Diesels. They're designed for heavy duty, economical operation, low maintenance costs, and long life. And Fairbanks-Morse Generators are built the same way. Fairbanks-Morse power generating units are engineered before you get them. One maker is responsible, one guarantee covers them. For information on how you can save on power, write Fairbanks, Morse & Co., Fairbanks-Morse Building, Chicago 5, Illinois.

BUY MORE WAR BONDS

Fairbanks-Morse

A name worth remembering

Diesel Locomotives • Diesel Engines • Generators • Motors • Pumps
Scales • Magnetos • Stokers • Railroad Motor Cars and Standpipes

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ATTACK *against dust* *with* TORNADO

KEEP dust "all out" with TORNADO—powerful, one-man portable Industrial Vacuum Cleaner. Its use insures quicker cleanups at less cost—floors, ceilings, walls, boiler tops. Gets rid of dust and dirt. Salvages scrap, flux, etc. Especially designed for industrial, heavy-duty type of cleaning. 1 h.p. G.E. universal motor. 49" waterlift, 175 c.f.m Weight 40 lbs. 12-gal. tank. Outside bag. Costs less than 3¢ an hour to operate.

Request details and FREE TRIAL Offer

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TAKE THE DUST OUT OF DUSTRY IN TORNADO

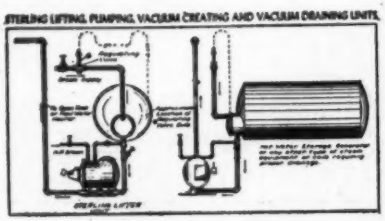
You Need To Save Fuel Now

THE EXCLUSIVE

Sterling

SYSTEM RETAINS CONDENSATE TEMPERATURE

Because it sends the condensate back to the boiler room under pressure, without venting to atmosphere.

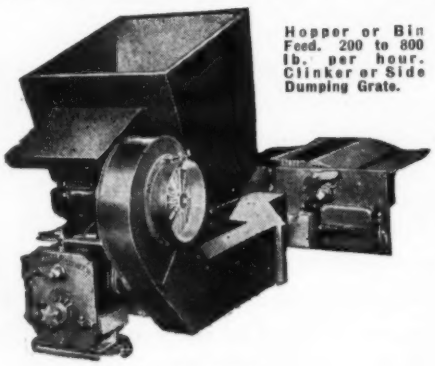


Sterling's Closed System then feeds the boiler with only a nominal line drop in temperature, giving maximum efficiency, economy and reducing boiler maintenance.

Sterling Engineering & Mfg. Corp.
(Templeton Mfg. Co.)
110 Business Street
Hyde Park, 36, Massachusetts

DON'T PLACE THAT ORDER!
BEFORE YOU INVEST IN A STOKER
INVESTIGATE THE FREDERICK . . .

Frederick Stokers deliver maximum amount of heat from every ton of coal consumed. This is due to Frederick *design* which insures (1) thorough fuel combustion (2) maximum utilization of heat-giving gases and (3) results in less coal burned and more heat generated. Frederick Stokers are constructed to withstand the rough usage of industrial installations. Send for the stoker catalog and find out about Frederick *engineered* features—



Hopper or Bin Feed. 200 to 800 lb. per hour. Clinker or Side Dumping Grate.

A—Fully active grate surface . . . no dead plates.
B—Continuous speed type transmission.
C—Completely enclosed windboxes and mechanism.

For these and other reasons the Frederick Stoker is highly regarded and widely used. Write for catalog . . . today.

WE ALSO MANUFACTURE fine Centrifugal Pumps . . . especially designed for efficient service in a specific industry. Engineering consultation available without obligation.

THE Frederick IRON & STEEL CO.
Frederick, Maryland

STOKER SPECIALISTS SINCE 1918

Another Highly Successful Community Refrigeration Center

The Consumers Ice and Coal Co., Lancaster, Penna., provides refrigeration service to more than 2500 customers. The plant has been making ice for over 40 years; now produces 90 tons daily, serves town and country routes, and ices refrigerator cars; but ice comprises only one fifth of its business. • Its locker system is one of the largest and finest in the country; complete with processing equipment, chilling and ageing rooms, quick-freezer, and 2200 food compartments; it also has 3 sub-stations in nearby towns. • Thousands of pounds of locally grown fruits and vegetables are cleaned, graded, quick-frozen, packaged, and sold under the "Consumers" label, each season. Four Blizzard freezers handle this load. Six freezer storage rooms hold 3 million lb. of various frozen foods. • Fresh fruits (up to 75,000 bushels) are stored, not to mention carloads of such products as cheese, cream, cabbage, meats, potatoes, etc. • Frick refrigerating, ice-making, quick-freezing, and cold-storage equipment is used throughout. • A similar COMMUNITY REFRIGERATION CENTER could be of great service to YOUR town. Get in touch with your nearest Frick Branch Office, or write direct to

Ice Service

Preparing Locker Foods

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2200 Food Lockers

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Frick Blizzard Freezers

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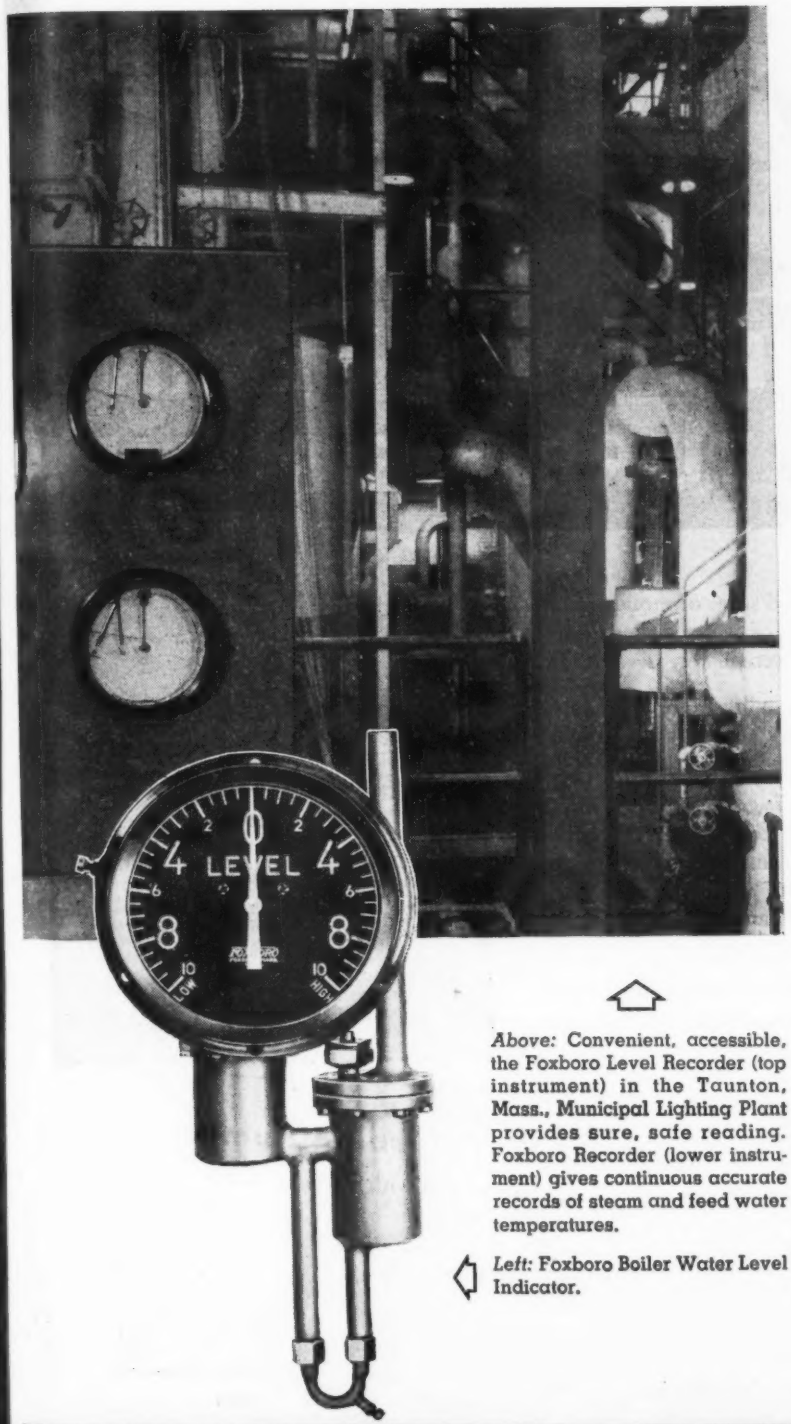
They Even Prevent Human Forgetfulness!



Above: Convenient, accessible, the Foxboro Level Recorder (top instrument) in the Taunton, Mass., Municipal Lighting Plant provides sure, safe reading. Foxboro Recorder (lower instrument) gives continuous accurate records of steam and feed water temperatures.

Left: Foxboro Boiler Water Level Indicator.

Foxboro Liquid Level Indicators and Recorders bring boiler-water readings out where they practically can't be overlooked!

Here's a typical example of the engineering thoroughness that goes into the design of every type of Foxboro Instrumentation.

Even the hazards of human carelessness in boiler operation have been foreseen in the design of Foxboro Boiler Water Level Instruments. These safer level gauges are designed for mounting at eye-level in the most-accessible location . . . *where frequent reading practically can't be overlooked!*

What's more, the Indicator has a highly visible dial that shows up clearly in any light where men can work. The Recorder not only permits easy check-up at any instant, but provides continuous graphic records to *prove* whether correct level has been maintained.

Foxboro Boiler Water Level Indicators and Recorders are made for any pressures encountered in modern steam power plant practice. Simply, ruggedly constructed to serve many years without maintenance. No glass to break . . . easily installed without disturbing the gauge-glass. Write for detailed information. **The Foxboro Company, 68 Neponset Avenue, Foxboro, Mass., U. S. A.**

ATLANTA, GA., Room 713, 101 Marietta Street Bldg.

FOXBORO
REG. U. S. PAT. OFF.

BOILER WATER LEVEL INSTRUMENTS

WHEW! OUR WATER BILLS LOOK LIKE THE PUBLIC DEBT!

SOLUTION: INSTALL A DEMING DEEP WELL TURBINE PUMP!

Many large volume users of water waste untold sums of money annually by not utilizing readily available sources of water either underground on their own property, or from adjacent lakes, streams, etc.

In contrast, many other companies formerly paying high water rates, checked up on the costs of owning their own supply and installed Deming Deep Well Turbine Pumps.

In numerous instances, the first year's *savings* accruing from a company-owned water supply paid for the cost of drilling the well, installing the Deming Turbine Pump, and attendant costs of depreciation and interest on the investment. After the first year, or less, savings accumulated rapidly as maintenance costs on Deming Turbine Pumps are remarkably low.

It costs nothing to find out if YOUR company can effect appreciable savings on water costs by installing a Deming Deep Well Turbine Pump.

How to check up on Deming Deep Well Turbine Pumps

Deming Distributors are located in every industrial area in the U. S. A. If you don't know the identity of the Deming Distributor in your area, write us. Ask for illustrated Bulletin 4700-8 which gives detailed information about Deming Deep Well Turbine Pumps. Write THE DEMING COMPANY, SALEM, OHIO.

DEMING

THE COMPLETE LINE

PUMPS AND WATER SYSTEMS

The Deming Company • Salem, Ohio

MIGHTY PULLING POWER

plus a grip that holds like a friction clutch

Gilmer BELTS

THE straight sides of Gilmer V-Belts bulge outward instantly as they flex around the sheaves. This exerts a pressure against the groove sidewalls, locking belts with a grip like that of a friction clutch. As belts straighten out, when pressure is released, they unlock smoothly and easily.

Stretch is controlled by pre-testing of the multiple-strand plies in the load-pulling section. As a result, belts operate within narrow limits of elongation, yet provide an ample safety margin of tensile strength. And the high flexibility of Gilmer V-Belts enables them to maintain full contact even on small diameter sheaves and short center drives.

Gilmer V-Belts stand up long in hard, continuous service. Special compounds, developed by Gilmer research, thoroughly bond the pulling cords, keeping them separated and in position, thus eliminating internal friction. Heavy jacketed construction provides adequate protection and strong resistance to wear.

There is a Gilmer V-Belt for every power-transmission need — FHP and multiple, endless and non-endless. And there are sizes to meet all requirements, for Gilmer has the largest assortment of V-moulds in the world.

Write for a FREE copy of the Gilmer Guide, the most complete V-Belt catalog in the field. It contains valuable engineering information, Standard sheave and belt tables, and other useful data.

L. H. GILMER COMPANY, Tacony, Philadelphia 35, Pa.

DIVISION OF UNITED STATES RUBBER COMPANY

EXIDES ASSURE TOP PERFORMANCE

IN DIESEL ENGINE CRANKING

A major reason for the outstanding success of Exide Batteries for Diesel engine cranking is this: they are designed specifically for the job. They incorporate every feature the task requires—extra power, ruggedness, and the ability to give reliable performance under all climatic extremes.

For years Exide Batteries have been the power plant engineer's first choice for Diesel engine cranking. He knows that as Diesel engineering advances, Exide engineering is keeping pace step by step. He has equal assurance that as new developments are effected there will be powerful Exides ready to bear the cranking load. Tomorrow, as today, you can count on Exide dependability, long-life and ease of maintenance.

Write today for a FREE copy of the Exide Catalog on Heavy-Duty Batteries. It gives you catalog data and information on how to get the most from your Heavy-Duty Batteries.

ARMY E NAVY

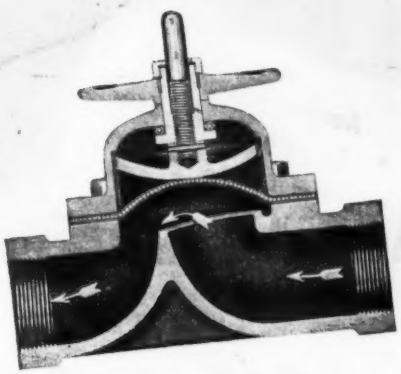
Exide
BATTERIES
FOR CRANKING
DIESEL ENGINES

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 32
Exide Batteries of Canada, Limited, Toronto

Not Acids...Alkalies...Abrasives nor Suspended Solids can Corrode, Abrade or Jam this

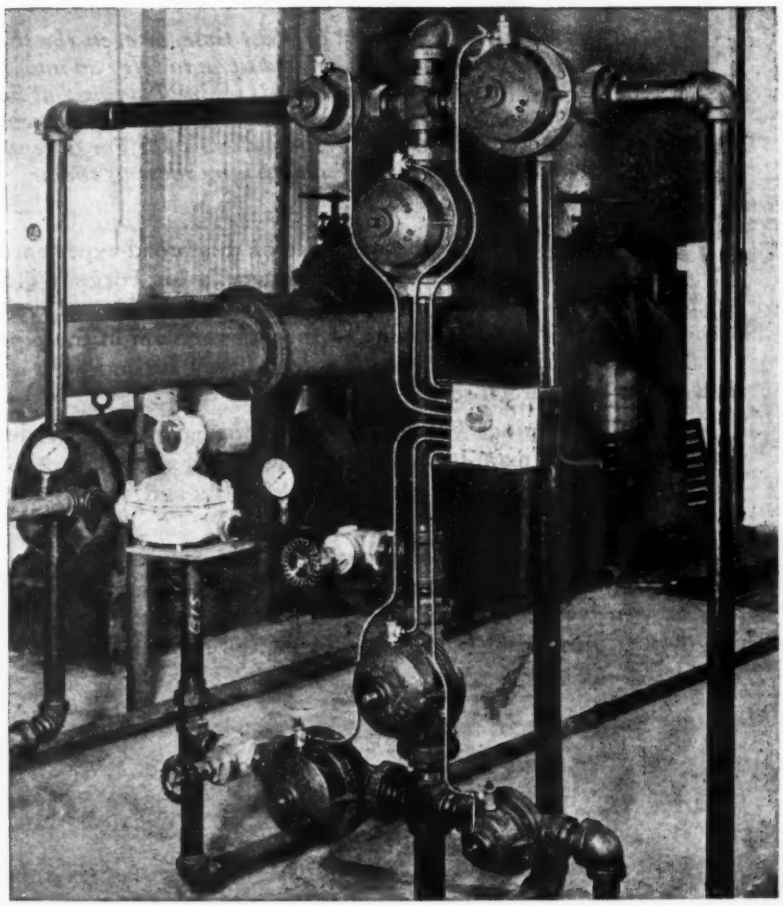
NEW DIAPHRAGM VALVE

McALEAR NO. M-1455 Corrosion and Abrasive Proof Diaphragm Valve. Pressures to 150 lbs. Temperatures to 150° F. Sizes ½" to 6"



This valve—not yet 1 year old—has already replaced more expensive valves in a goodly number of chemical plants, industrial plants, mines, sewage disposal plants, water works, paint factories, paper mills, food processing and other industries. It has proved practically indestructible in service with upwards of 100 acids, alkalies, abrasives and suspended solids.

Below: **PILOT OPERATED TYPE** controlling flow rate, backwash and rinse cycles in Mid-West industrial plant



Trouble-Free

THIS VALVE cannot freeze in outdoor service—has no stuffing box—requires no repacking. It does not depend on metal-to-metal contact for closure. Hence *cannot* leak and *never* requires reseating. Positive shut-off is provided by diaphragm—*even* when solids are trapped on the seat.

Installable *in any position* without danger of leaks. Special types may be operated from remote points by air or water pressure, controlled by automatic time-clock or pilot. For Diaphragm Valve Bulletin giving complete data, write Automatic Control Division, Climax Industries, 1913 S. Western Avenue, Chicago 8.

CLIMAX ENGINEERING COMPANY

WELDED TANKS
BOLTED TANKS
SEPARATORS

McALEAR
PRESSURE · FLOW · LIQUID LEVEL · TEMPERATURE
controls
for STEAM, WATER, AIR, OIL-GAS

Tail wags dog—

★ *This is the first time we ever made this odd size-combination of welding tees larger in the branch than in the run. They are seamless carbon-moly forgings with a seven-inch branch, but only five inches in the run—a sort of tail-wags-dog idea called for by a peculiar set of conditions.*

However, this is definitely not the first time, or even the thousandth time, that we have been called upon to solve an unusual, first-time, forging problem like this. It is simply typical of hundreds of special—often extremely difficult—problems turned over to us by engineers who respect the Taylor Forge reputation for "meeting all comers" and licking most of them.

DO NOT underestimate the influence of this broad experience on our standard line of WeldELLS and other Taylor Forge Welding Fittings. It is the sound, practical kind of experience acquired in handling just about every conceivable kind of forging problem in the piping field . . . and it was full grown long before welding fittings were ever produced on a commercial scale!

Thus, in developing WeldELLS we did not have to ask what kind of fitting is easiest to manufacture. Instead we could ask what comprises the ideal fitting, and then, with every special facility and process at our command, make that ideal a reality.

That is why WeldELLS alone combine the features listed opposite . . . why they have extra metal distributed where stresses are greatest . . . why they have such extremely accurate dimensions . . . why they have tangents and those "convenience" features which speed up welding and cut costs. That is why, in short

WeldELLS alone combine these features:

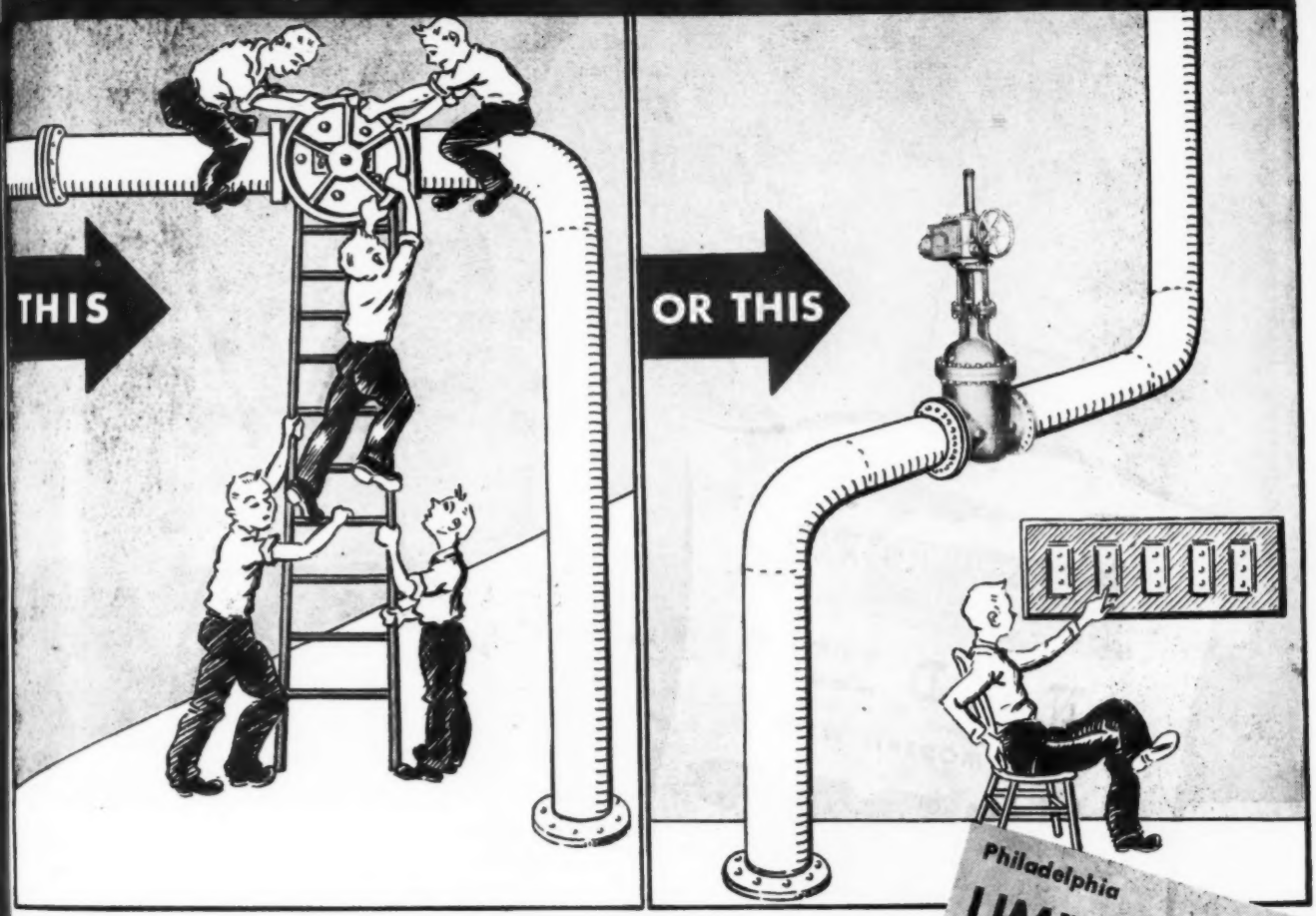
- **Seamless**—greater strength and uniformity.
- **Tangents**—keep weld away from zone of highest stress—simplify lining up.
- **Precision quarter-marked ends**—simplify layout and help insure accuracy.
- **Selective reinforcement** — provides uniform strength.
- **Permanent and complete identification marking** — saves time and eliminates errors in shop and field.
- **Wall thickness never less than specification minimum**—assures full strength and long life.
- **Machine tool beveled ends** — provides best welding surface and accurate bevel and land.
- **The most complete line of Welding Fittings and Forged Steel Flanges in the World**—insures complete service and undivided responsibility.

WeldELLS have everything

TAYLOR FORGE & PIPE WORKS, General Offices & Works: Chicago, P. O. Box 485
New York Office: 50 Church Street • Philadelphia Office: Broad Street Station Building

WHICH

SAVES TIME
SAVES TROUBLE
PROVIDES GREATER SAFETY



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LIMITORQUE
VALVE CONTROLS

The striking contrast between opening or closing similarly sized valves manually or with LimiTorque Valve Operators is clearly demonstrated in these drawings. LimiTorque Controls enable one man to operate valves up to 96" diameter by merely pushing a button at a centrally located master control panel or a convenient individual push button station. This permits the valve to function at maximum desired speed while eliminating all physical hazards to the workmen.

Remote operation of valves from one central point with a full knowledge of their status at all times is entirely practical with LimiTorque. There are several types of LimiTorque Controls applicable for operating all types and sizes of valves and which can be adapted to existing equipment if desired. Floor stand controls can be furnished where it is not practical to fit the controls directly to the valve yokes.

Write us for more details . . . on your business letterhead, please

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Philadelphia
GEAR WORKS INCORPORATED

ERIE AVE. AND G ST., PHILADELPHIA 34, PA. NEW YORK • PITTSBURGH • CHICAGO

Industrial Gears and Speed Reducers
LimiTorque Valve Controls

In converting an old textile mill to the manufacture of highly inflammable photographic film, the first requirement was that the interior of the building be completely fire-proofed. Partitions, panelling and ceilings of "Century" APAC made this requirement a reality.

In addition, this all-purpose asbestos-cement sheet material proved to be easy to cut and handle on the job, quickly installed . . . structurally strong . . . absolutely dependable.

Just a few of the hundred and one uses of K&M "Century" APAC in industrial plants are as interior sheathing of all kinds, linings for elevator casings and shower stalls. It is also ideally suited for exterior roofing and siding. "Century" APAC has solved many new construction and repair problems. It is effective, economical and keeps maintenance costs amazingly low.

You'll understand why industrial engineers turn to K & M "Century" APAC when you check these advantages:

1. Made of Asbestos Fibre and Portland Cement.
2. Pleasing light gray color.
3. Fire resistant and durable.
4. Convenient size—4' x 8'. Thicknesses 3/16" 1/4" and 3/8".
5. Low cost.
6. Rat and termite proof.
7. Easy to cut, handle and apply.
8. Fastens with nails or screws.
9. Practically no maintenance required.
10. Prompt delivery.

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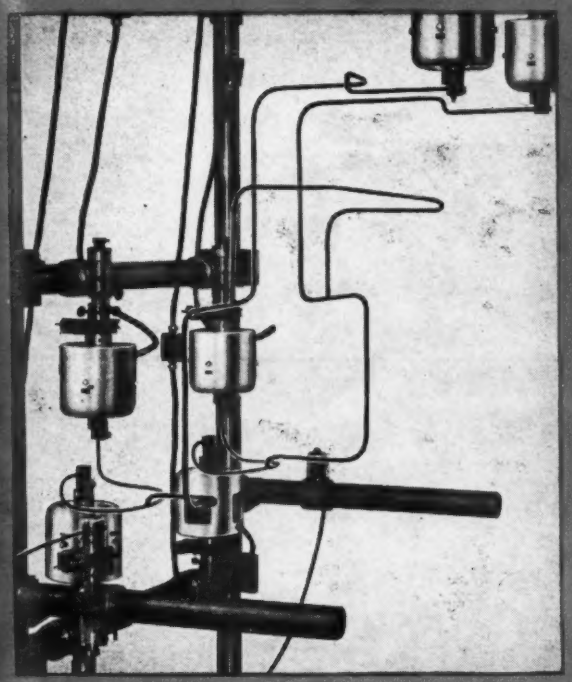
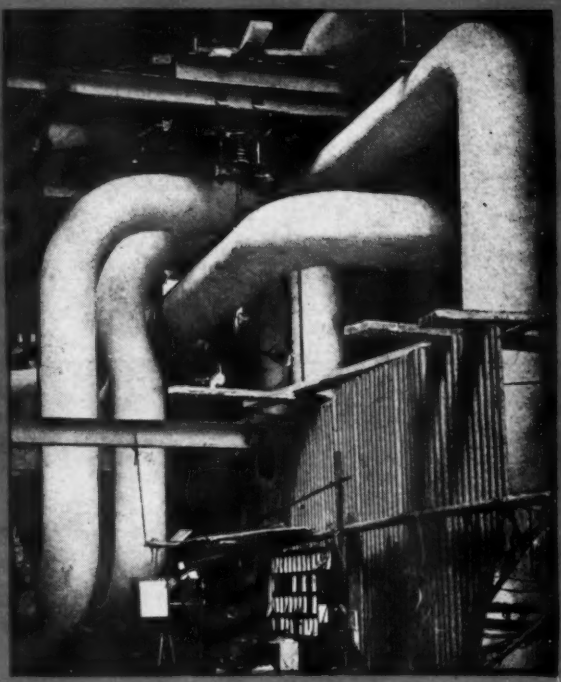
K&M
best in asbestos

KEASBEY & MATTISON
COMPANY • AMBLER • PENNSYLVANIA





KELLOGG

PIPING PROBLEMS
are Solved in Advance in the
KELLOGG LABORATORIES

Extremely accurate stress analysis of scale models, using electrical strain gauges, measuring load deflections to one millionth of an inch, enables Kellogg to furnish piping systems with complete assurance that they will perform as required when the plant is put in operation.

The "bugs" are thus found and eliminated even before the final drawings are allowed to go to the shop. This *design research* explains the acknowledged superiority of KELLOGG pipe installations. This is an exclusive Kellogg service available to consulting, power, process and marine engineers.

KELLOGG

"Masterflex" Prefabricated Piping Systems · "Masterweld" pressure vessels for Power, Refinery and Chemical Industries. Heat Exchangers. Pyrolytic and Catalytic Cracking Units, Hydroforming, Reforming, Dehydrogenation, Alkylation, Desulphurization. Thermal and Catalytic Polymerization Units · JUIK Processes for Lubricating Oil Plants. Plastic Refractories · Radial Brick Chimneys.

THE M. W. KELLOGG COMPANY · JERSEY CITY, NEW JERSEY · 225 BROADWAY, NEW YORK 7, N. Y.

REPRESENTATIVES

LOS ANGELES: 609 SOUTH GRAND · HOUSTON 2, TEXAS: 402 ESPERSON BLDG. · TULSA: PHILTOWER BLDG.

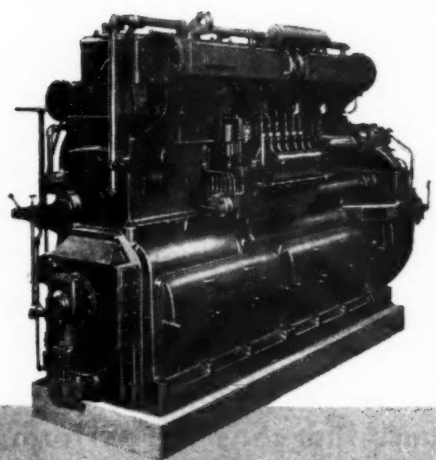
There's a lesson for power-interested men in these modern ferries, for which ALCO diesel engines furnish smooth, purring power—quick, dependable power—plus space saving for more pay load!

CLEAN, smokeless power—fast, dependable and almost silent—from ALCO diesel engines—moves these finer ferries of today.

Gone are the murk and dirt inseparable from boiler firing. Light-weight, high-speed, compact, heavy-duty diesel engines of greater dependability, pioneered by ALCO, have ended all need for tolerating this nuisance.

Ashore or afloat, more than a million and a half horsepower of ALCO diesel engines, in hundreds of applications, are proving conclusively the superiority of this better power supply...always instantly available.

Plan now to make use of ALCO diesel engine advantages for your power requirements, marine or stationary.



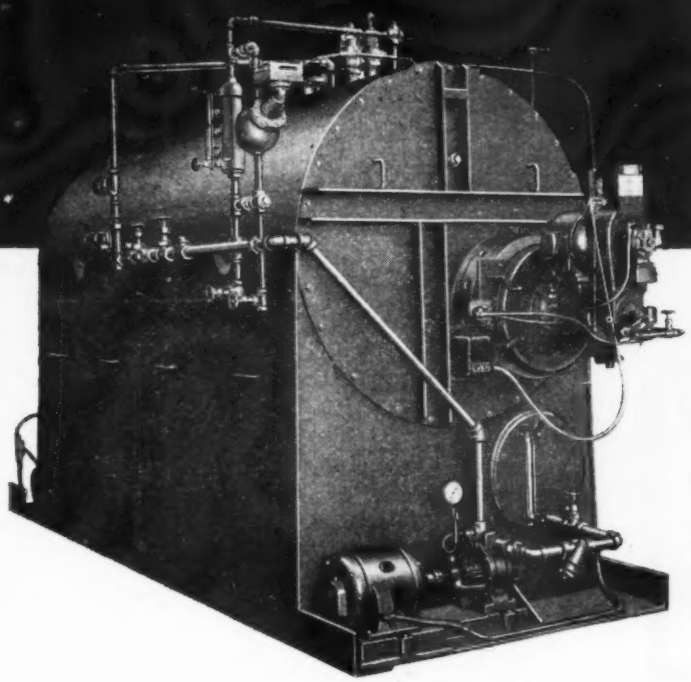
American Locomotive

ALCO DIESEL ENGINES

For Universal Application

30 Church Street, New York 8, N. Y.

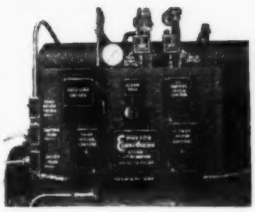
Dutton ECONOTHERM
AUTOMATIC STEAM GENERATOR



AUTOMATIC CONTROLS

Less Supervision
Greater Efficiency

Includes every instrument and control necessary for fully automatic operation.



The Econotherm is the result of our experience in building steam generators to meet the Armed Forces' demand for a packaged, "set down and run" boiler to develop the greatest steam capacity in the smallest possible space. Some of the features that make the Econotherm outstanding in performance and economy are:

SELF CONTAINED: A complete steam plant in one compact insulated unit — assembled and ready to run. All piping and wiring done at factory. Practically no installation cost.

MULTI-PURPOSE: A versatile unit designed for all industrial, commercial and heating needs from 15 to 150 HP in pressures of 100, 125 and 150 pounds.

FACTORY TESTED: Every unit tested under actual operating conditions before shipped.

COMPLETELY AUTOMATIC: Dutton automatic controls regulate every function including maintaining uniform steam pressure and the normal water level within desired limits. Top efficiency, economy and safety guaranteed with minimum attention.

FASTER STEAM — MORE STEAM: The exclusive Dutton designed Rotary Burner, Induced Draft System and Three Pass Heating combine to give you increased firing rate and quicker steaming to meet maximum steam demands instantly. Either Gas or Oil fired.

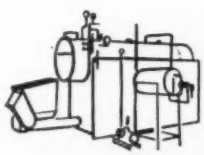
NO CHIMNEY: Smokeless because gases are scavenged — small pipe carries flue gases outside boiler room.

SAVES SPACE: Extremely compact. Twice the power in half the usual space.

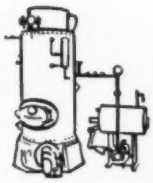
CLEANER: Dutton combustion principles produce perfectly clean operation. No messy, cluttered up boiler room.

WRITE FOR FULL INFORMATION

DUTTON ECONOMIST HIGH PRESSURE BOILERS



Dutton



DUTTON AUTOMATIC VERTICAL BOILERS

PRESSURE VESSELS • HEAT EXCHANGERS • CONDENSERS

THE C. H. DUTTON COMPANY • 622 GIBSON STREET • KALAMAZOO, MICHIGAN

Wire Rope Value Begins With Wire

WHAT DETERMINES THE PERFORMANCE you get from elevator wire rope? It's the care it gets—the sheaves it runs over—the way the elevators are maintained.

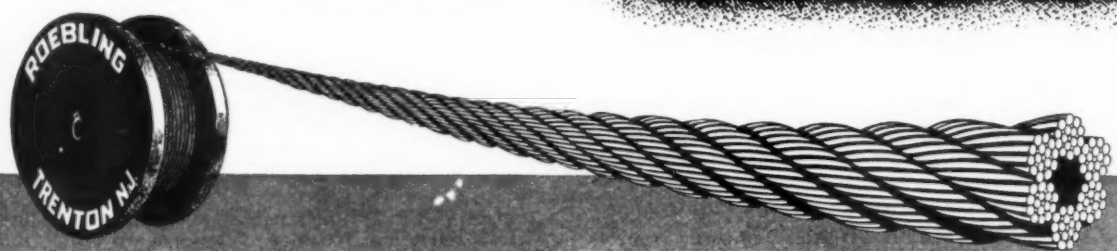
All these count. But what counts *most* is the rope itself. And that's the reason why you should equip your elevators with Roebling "Special Traction Steel" Elevator Rope.

For here's a rope that gives you safe, dependable performance—even under severe and abusive conditions. It's rope quality that begins with wires drawn from finest steel... Roebling-made!

To get the *best* results from "Special Traction Steel" Elevator Rope, select the right rope . . . and use it right. Roebling engineers will be glad to show you how. Call or write our nearest branch office.

JOHN A. ROEBLING'S SONS COMPANY
TRENTON 2, NEW JERSEY
Branches and Warehouses in Principal Cities

WIRE ROPE AND STRAND • FITTINGS • SLINGS AERIAL WIRE ROPE SYSTEMS • SUSPENSION BRIDGES AND CABLES • COLD ROLLED STRIP • HIGH AND LOW CARBON ACID AND BASIC OPEN HEARTH STEELS • ROUND AND SHAPED WIRE • ELECTRICAL WIRES AND CABLES • WIRE CLOTH AND NETTING • AIRCORD, SWAGED TERMINALS AND ASSEMBLIES

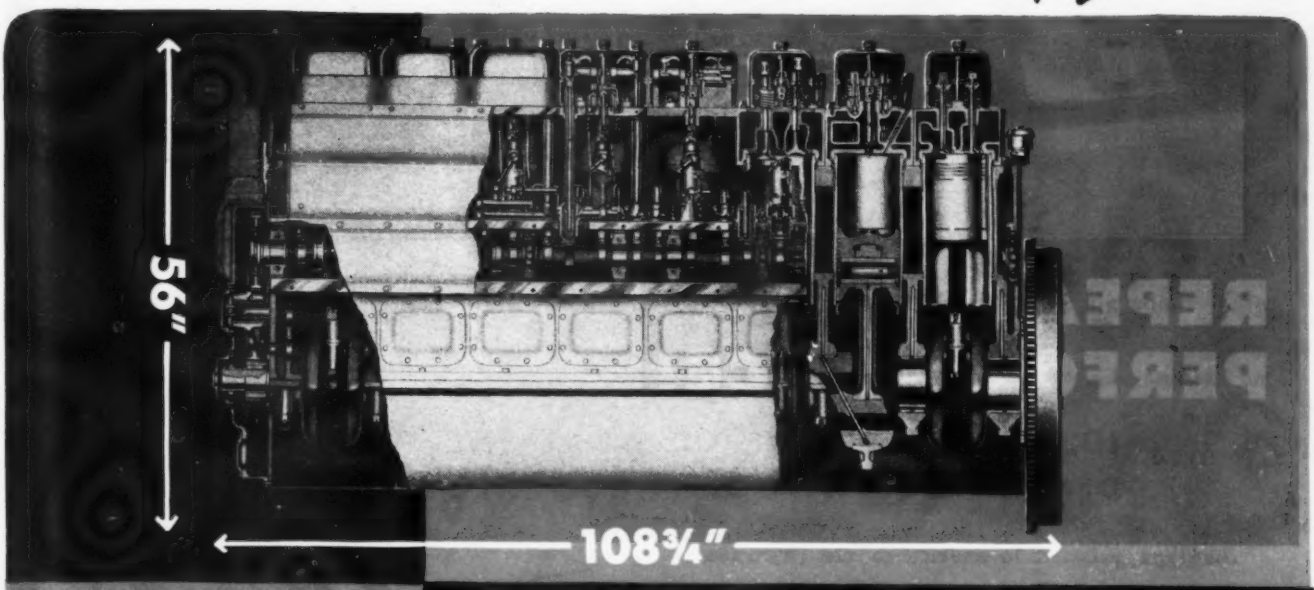


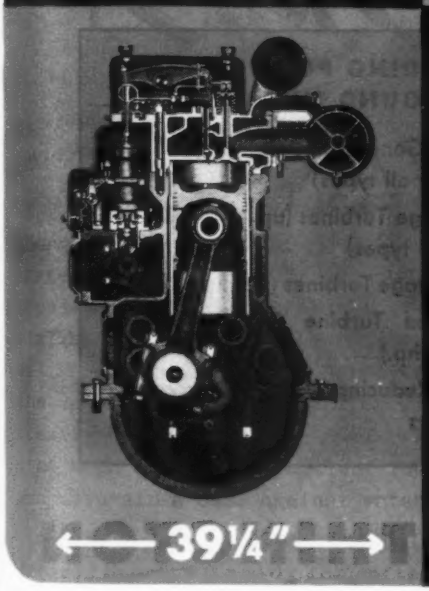
ROEBLING

PACEMAKER IN WIRE PRODUCTS

DIESELS *by Sterling* COMPACT

... and loaded with operating features

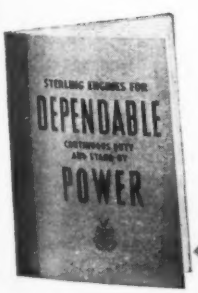




HORSEPOWER RATINGS AND WEIGHT

	6 CYLINDER Unsupercharged	6 CYLINDER Supercharged	8 CYLINDER Unsupercharged	8 CYLINDER Supercharged
CONTINUOUS	275 HP at 1000 RPM	410 HP at 1000 RPM	365 HP at 1000 RPM	550 HP at 1000 RPM
INTERMITTENT	325 HP at 1200 RPM	495 HP at 1200 RPM	440 HP at 1200 RPM	650 HP at 1200 RPM
ENGINE WEIGHT	8,000 Pounds	8,600 Pounds	9,000 Pounds	9,600 Pounds

Here are a few features that make the new Viking Diesel outstanding: Compact as a gasoline engine with the same power rating. Modern engineering design reduces fuel consumption per brake horsepower. Greater accessibility for servicing and making adjustments. Crankcase and cylinder block cast in one piece making for better rigidity of construction. These features and many others that are engineered into the Viking Diesel are fully described in technical bulletins that will be furnished without obligation. Orders accepted now for early delivery.

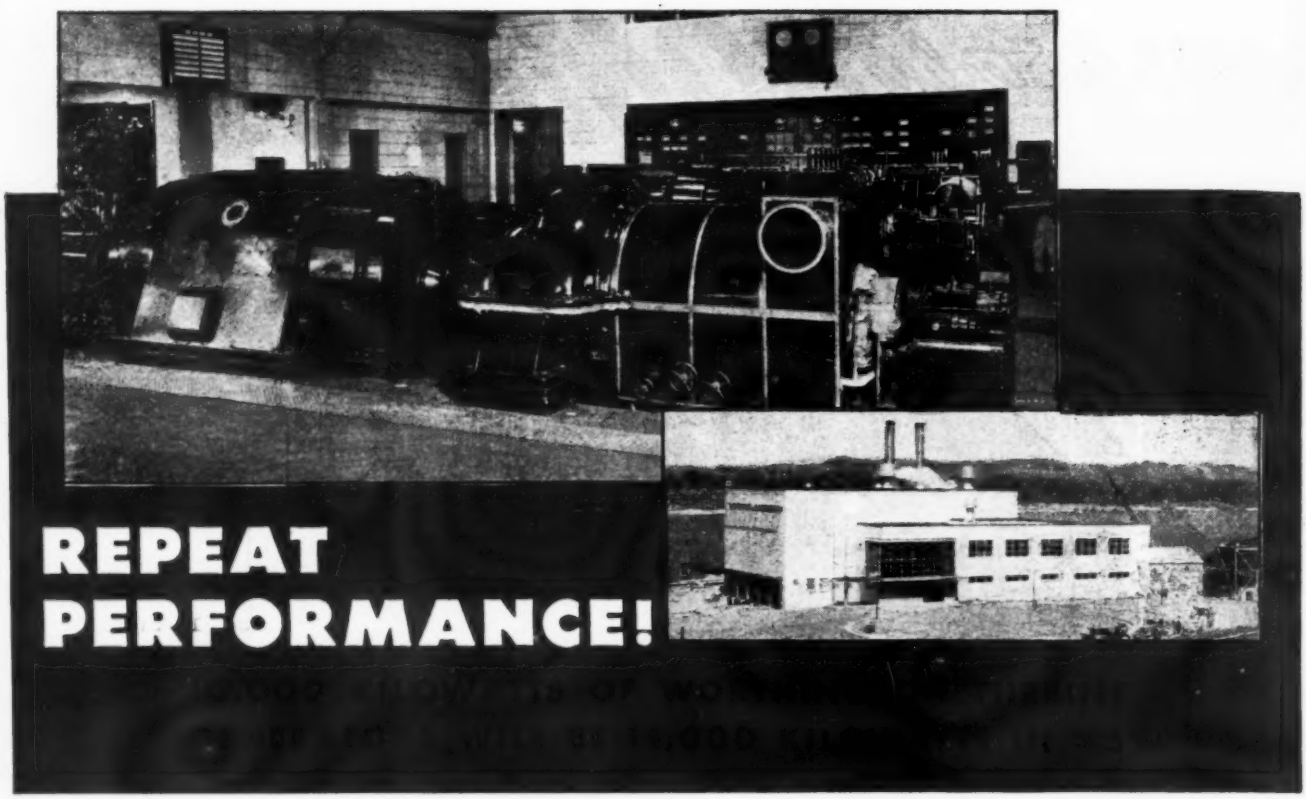


EVERY OPERATING EXECUTIVE will want this new booklet, "DEPENDABLE POWER" describing the complete line of Sterling engines—gasoline, gas and diesel, ranging from 75 to 1800 hp.

STERLING ENGINE COMPANY • 1271 Niagara Street, Buffalo 13, New York

New York City, 900 Chrysler Building • Washington, D. C., 806 Evans Building • Chicago, Illinois, 855 Board of Trade Building

DISTRIBUTORS IN PRINCIPAL CITIES



REPEAT PERFORMANCE!

For the third time since 1940, Dairyland Power Cooperative is installing an *additional* Worthington Turbine Generator in its Genoa, Wisc., Power Plant, supplying electricity to farm communities of Wisconsin, Iowa and Minnesota.

One of the outstanding power cooperatives of the country, Dairyland will have 14,000 KW of installed Worthington turbine generators, when the 4000 KW unit now being built is installed.

All units operate with 650 psi initial steam pressure . . . at 825° F. . . . and exhaust to 28.5 inches vacuum. Write for complete details. *Worthington Pump and Machinery Corporation*, Moore Steam Turbine Division, Wellsville, N. Y.

IN LEADING POWER PLANTS AROUND THE WORLD

- Turbine Generator Units (up to 7500 kw.—all types)
- Multi-stage Turbines (up to 10,000 hp. —all types)
- Single Stage Turbines (up to 1500 hp.)
- Combined Turbine & Gear (5 to 200 hp.)
- Speed Reducing & Speed Increasing Gears

WORTHINGTON

MOORE STEAM TURBINE DIVISION

Nationwide Service—Offices and Representatives Throughout the World

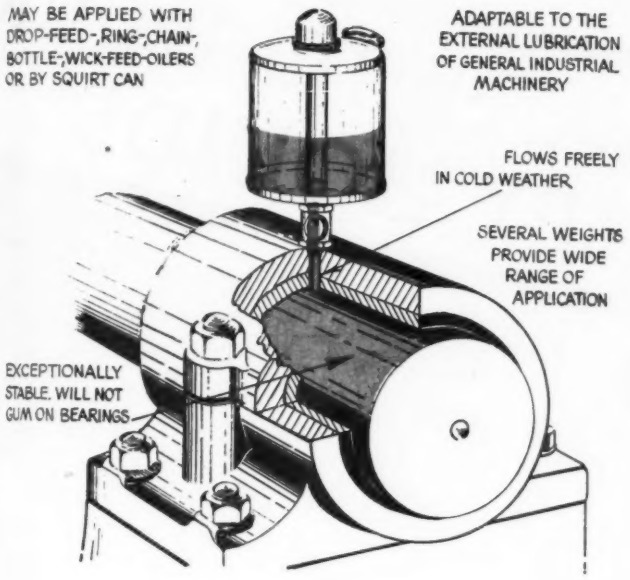
T4-10

A GREAT TEAM IN STEAM

STANDARD ENGINEERS NOTEBOOK

VOL. 2-W No. 8

Stable, all-purpose oils stop wear on external bearings


MAY BE APPLIED WITH DROP-FEED-, RING-, CHAIN-, BOTTLE-, WICK-FEED-OILERS OR BY SQUIRT CAN
ADAPTABLE TO THE EXTERNAL LUBRICATION OF GENERAL INDUSTRIAL MACHINERY
FLOWS FREELY IN COLD WEATHER
SEVERAL WEIGHTS PROVIDE WIDE RANGE OF APPLICATION
EXCEPTIONALLY STABLE. WILL NOT GUM ON BEARINGS

Because they are carefully refined for stability, Calol Red Engine Oils are always the same and may be depended upon to give constant, uniform protection to external bearings on all general industrial machinery. With a comparatively low carbon residue and low pour test, they have a wide range of application in all atmospheric temperatures.

They are made in five viscosity grades:

Calol Red Engine Oil—11. An all-purpose grade which can be filtered for re-use. It is used on engine bearings, machinery and shafting.

Calol Red Engine Oil—15. Heavier than Number 11 and used for the same general purposes.

Calol Red Engine Oil—18. Used on slow-speed bearings, air cylinders of blowing engines.

Calol Red Engine Oil—20. A heavy grade for heavy-duty machinery bearings.

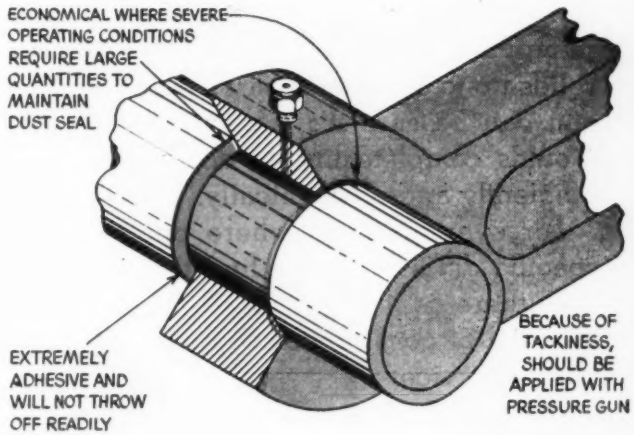
Calol Red Engine Oil—25. The heaviest grade, used for the same purposes as Number 20.

Tacky greases seal out dust and water

Where rough, grease-lubricated bearings must operate in severe conditions, Calol Multi-Service Greases are recommended. Black in color, these special base greases are blended into a heavy, rugged oil. The lubricant film they provide stands up under the heaviest shock loads. Because they are extremely adhesive, Calol Multi-Service Greases resist high centrifugal action. They are economical and maintain a seal against water and dirt.

There are seven grades of Calol Multi-Service Grease: Numbers 0 and 1, the softest, are non-fluid at ordinary temperatures. Number 0 is particularly adapted for use in cold weather. Numbers 2 and 3 are slightly heavier in consistency and higher in melting point. Numbers 4, 5 and 6 are very stiff.

In the proper grades, Calol Multi-Service Greases are used on small enclosed gears, on ball and roller mine car wheels, heavy-duty chassis, rough machinery bearings and low-speed journal bearings.


ECONOMICAL WHERE SEVERE OPERATING CONDITIONS REQUIRE LARGE QUANTITIES TO MAINTAIN DUST SEAL
EXTREMELY ADHESIVE AND WILL NOT THROW OFF READILY
BECAUSE OF TACKINESS, SHOULD BE APPLIED WITH PRESSURE GUN

HIGHLY RESISTANT TO MOISTURE

MAINTAINS RICH OIL FILM THAT RESISTS DISPLACEMENT BY SHOCK LOADS

There is a Calol Product to meet every industrial lubrication problem. For information, write Standard of California, 225 Bush Street, San Francisco 20, California.

STANDARD OF CALIFORNIA

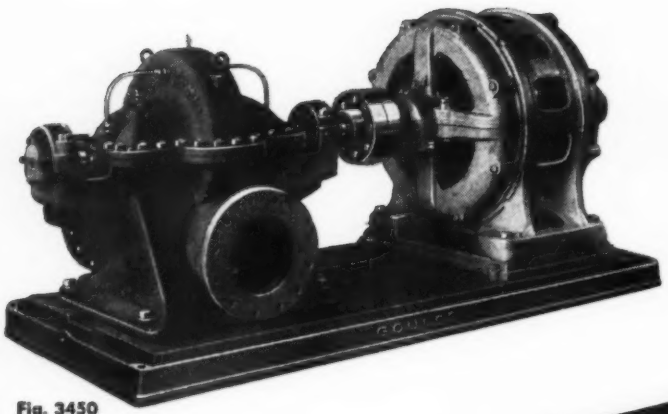
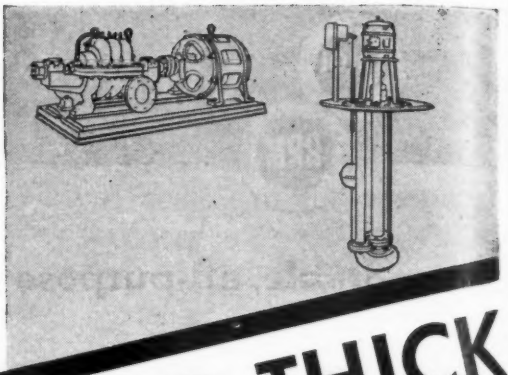


Fig. 3450
DOUBLE SUCTION
SINGLE STAGE CENTRIFUGAL



FROM CLEAR WATER TO THICK PULPY LIQUIDS

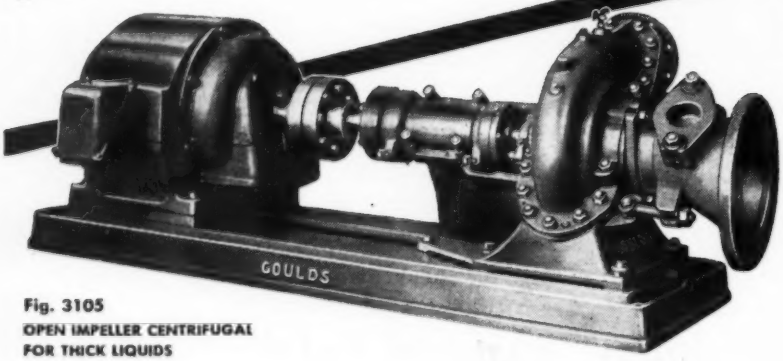
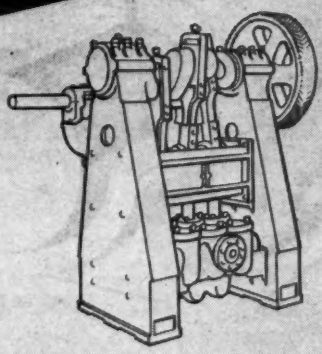
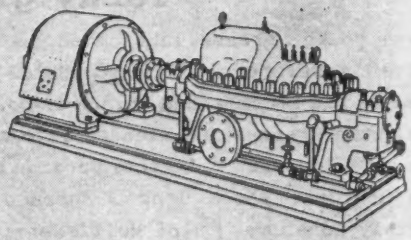


Fig. 3105
OPEN IMPELLER CENTRIFUGAL
FOR THICK LIQUIDS





It may be a pump for handling clear water, or a pump handling heavy solutions containing suspended solids up to 3 inches in size. When it's a Goulds Pump you can be sure it's a pump that was selected from Goulds complete line to do that particular job most efficiently and economically.

For every process where pumps are required for specific duties you will find that in Goulds complete line there is the pump of the type, capacity and material of construction to give you trouble-free long lasting service.

Goulds ninety-seven years of pump building exclusively includes many years intensive study of the specialized needs of many industries. The results of this application are shown in the predominance of Goulds Pumps in so many fields. In whatever direction your postwar operations may lead, you can be sure that Goulds will go along with you and provide from its line of centrifugal, rotary and reciprocating pumps *the* Pump for *the* job.

Goulds

the PUMP FOR the JOB

GOULDS PUMPS, INC., SENECA FALLS, N.Y.

"NO DRIVE MAINTENANCE NEEDED

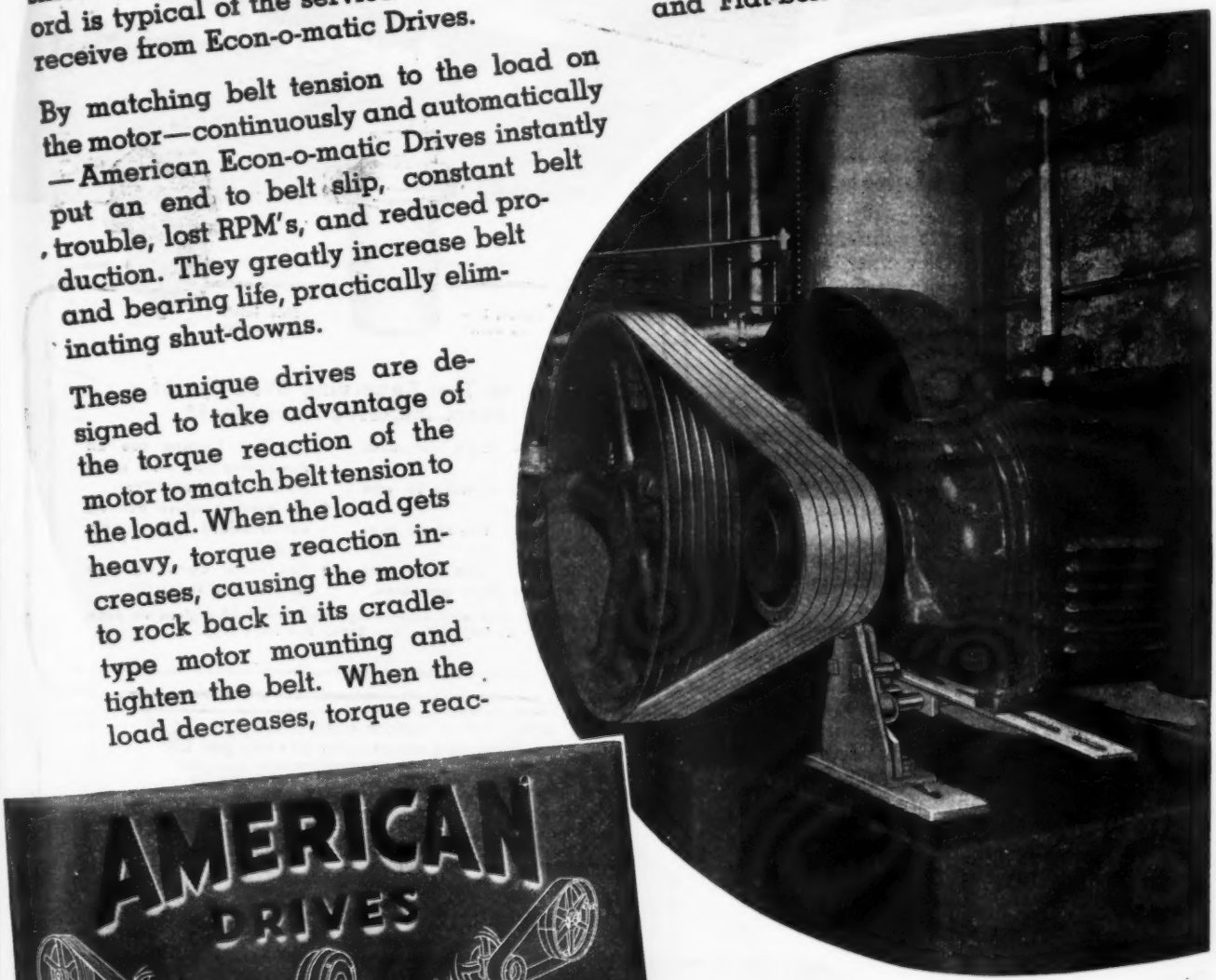
Since 1939!"

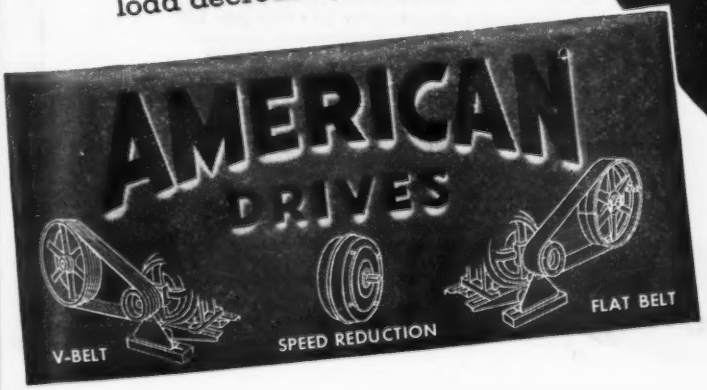
. . . reports the manufacturer who uses the American Econ-o-matic Drive shown in the photograph. Powered by a 40 H.P. motor, this drive has been operating a compressor 16 hours a day, 6 days a week, without a single time-out for maintenance since installation six years ago. That record is typical of the service our customers receive from Econ-o-matic Drives.

By matching belt tension to the load on the motor—continuously and automatically —American Econ-o-matic Drives instantly put an end to belt slip, constant belt trouble, lost RPM's, and reduced production. They greatly increase belt and bearing life, practically eliminating shut-downs.

These unique drives are designed to take advantage of the torque reaction of the motor to match belt tension to the load. When the load gets heavy, torque reaction increases, causing the motor to rock back in its cradle-type motor mounting and tighten the belt. When the load decreases, torque reaction also decreases and belt tension is automatically reduced.

To solve your short-center drive problems —to get the increased production you want —specify American Econ-o-matic Drives. Write today for your copy of the Econ-o-matic Handbook, which explains the Econ-o-matic principles and contains V-belt and Flat-belt Econ-o-matic Drive Tables.





The American Pulley Company
4224 WISSAHICKON AVE., PHILA. 29, PA.

One of a series of advertisements, each discussing trapping practice on a different class of equipment.

HOW TO TRAP STEAM JACKETED EQUIPMENT for faster heating

User Reports 75% Reduction in Cooking Time

Correct drainage of condensate from steam jacketed kettles, vats, cylinders, pans and similar equipment can save time and save steam. The table below contrasts proper trapping with drainage through a cracked valve. This is substantiated by other reports: a Chicago firm reduced cooking time on kettles 75%—from 40 minutes to 10 minutes; a California packing company reduced average cooking time from 27 to 17 minutes; other companies report similar benefits.

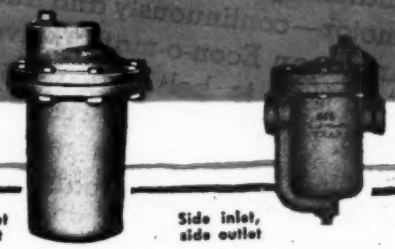
The reasons for these results are two:

1. Armstrong Trap design — no steam leakage, big air venting capacity, ability to discharge condensate as fast as it accumulates regardless of temperature.

2. Armstrong recommendations — covering trap selection and installation practice. Based on tests and experience on thousands of installations.

Armstrong traps are sold through leading distributors everywhere on a basis of "satisfaction *guaranteed*". For better trapping, write to

Armstrong Machine Works
812 Maple St., Three Rivers, Mich.



Some Tips Regarding Drainage of Steam Jacketed Equipment*

- Use one trap for each unit.
- Install trap close to and below unit.
- Use ample size steam supply lines.
- Size return lines to prevent excessive back pressures.
- For *fast* heating use an Armstrong trap with extra air handling capacity.
- For *medium speed* heating use standard Armstrong trap.
- For *slow* cooking use smaller size trap.

★ Complete data with engineering charts and tables given on page 29 of the *Armstrong Steam Trap Book*. Ask for a copy.

Table showing cost of various sized steam leaks at 100 pound pressure (assuming steam costs 50 cents per 1000 lbs.)

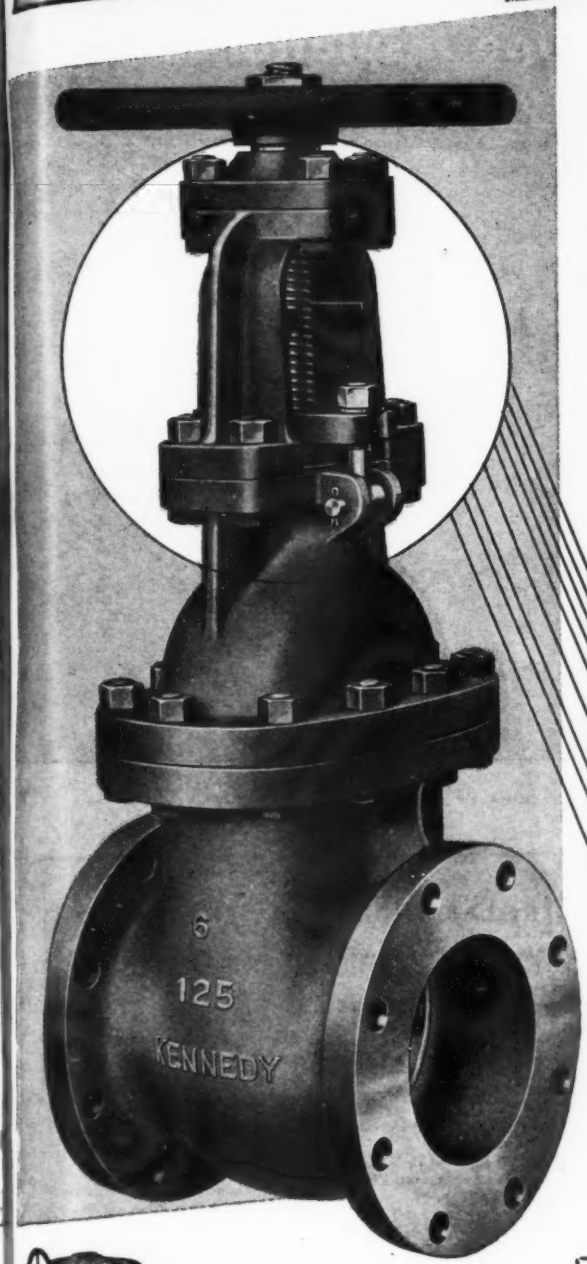
Size of Orifice	Lb. Steam Wasted Per Month	Total Cost Per Month	Total Cost Per Year
1/2"	835,000	$417.50	$5,010.00
1/4"	210,000	105.00	1,260.00
1/16"	13,200	6.60	79.20
1/32"	3,400	1.70	20.40

(For steam at 50 lbs. pressure, the waste is about 75% of the above figures: at 20 lbs., it is about 50%; and at 5 lbs., the loss is about 25%.)

ARMSTRONG *Inverted Bucket* STEAM TRAPS

Over a Million in Use...For Power...Process...Heating

Trifles make perfection but perfection is no trifle



A YOKE that does far more than merely "fasten together"

Originally, the word "yoke" was applied to the contrivance that kept two oxen or other draft animals in line. But the yoke of a Kennedy outside stem and yoke valve is far from merely a contrivance for alignment. Note these features for extra strength, convenience, and ease of operation in Kennedy Standard Iron Body Wedge Gate Valves:

- One-piece yoke, wide and ribbed
- Four large bolts at yoke cap
- Extra large bolts at yoke-bonnet connection
- Bronze-to-bronze stem thread contact surfaces
- Stem contact surface in yoke cap 1½ times stem diameter
- Collar to keep stem in alignment and to prevent side thrust of stem against packing
- Provision for lubricating yoke nut bearing surfaces
- Shelves to hold gland well out of the way when repacking
- Every bolt nut accessible to a standard open-end wrench

These details are typical of the many provisions for long-continued satisfaction built into every Kennedy Valve type . . . they indicate the many advantages of standardizing on these high quality valves.

Write for the Kennedy Catalog

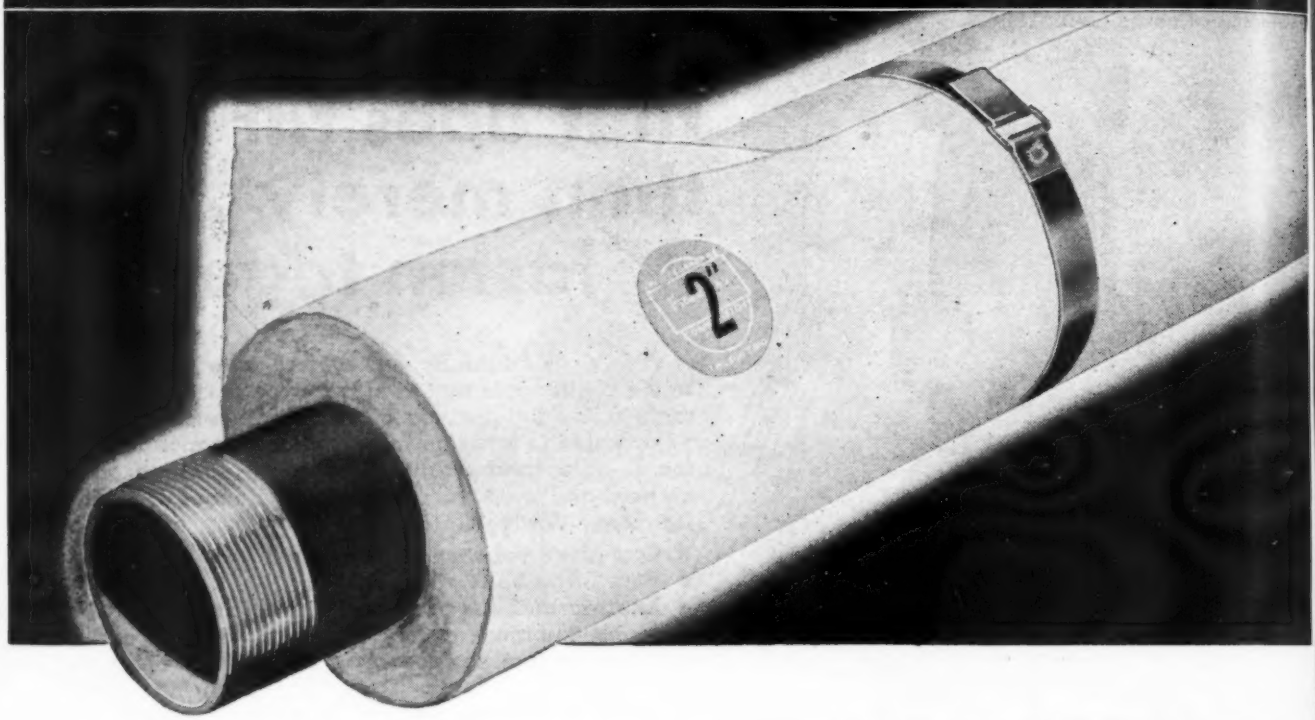
THE KENNEDY VALVE MFG. CO.
ELMIRA NEW YORK

One of a series of advertisements explaining how Kennedy gives careful attention to the details of valve design, construction and workmanship that provide maximum effectiveness, convenience, and length of service.

KENNEDY *valves . . . pipe fittings . . . fire hydrants*

Want to cut heat loss?

...use Fiberglas* PF Pipe Insulation



In co-operation with the Government program to save critical fuel.

Important savings in heat and power are being obtained by the use of Fiberglas PF Pipe Insulation on steam and other hot lines up to 30" O.D., with temperatures up to 600° F

Made in three-foot sections, PF (Pre-Formed) pipe insulation is easy to handle and install. It can be cut with an ordinary knife to form a snug fit, even over couplings, with minimum loss of insulation thickness and efficiency. Couplings are invisible when work is finished. The fibrous ends of the sections intermesh to form tight joints.

PF has unusually low thermal conductivity. Made of fine glass fibers (Fiberglas), bonded with a thermo-setting binder and molded into standard sections and segments, it will not rot or decay. And because of its mechanical strength, this pipe covering holds its shape, withstands handling and is easily applied, particularly on the largest pipes, where only three segments are required.

There is a Fiberglas Insulation Material for every industrial need. Be sure to get complete information before specifying any insulation. See Sweet's files or write for a copy of "Fiberglas Insulations for Industry". *Owens-Corning Fiberglas Corporation, 2000 Nicholas Building, Toledo 1, Ohio.*

In Canada, Fiberglas Canada Ltd., Oshawa, Ontario.

FIBERGLAS INDUSTRIAL INSULATIONS

1. Blanket Type Pipe Insulation—With mesh wire on outer side to wrap around pipe and secure with wire through special edging. Manufactured in 2-ft. sections for pipes over 3" O.D. Will withstand temperatures up to 1000° F.

2. Metal Mesh Blankets—With mesh wire or expanded metal on one or both sides. Lightweight and easily applied. 2 ft. x 4 ft. and 2 ft. x 8 ft. In standard thicknesses. Two types: For temperatures up to 600° F. and 1000° F.

3. No. 600 PF Block—Same materials as in PF Pipe Covering — in blocks 6" x 36" and 12" x 36", standard thicknesses.

4. OC-1800 High Temperature Block—A highly efficient molded block in sizes 3" x 18" and 6" x 36" and 12" x 36"—in standard thicknesses. Will withstand surface temperatures up to 1800° F.

5. Insulating Cement—For insulating fittings, valves and all irregular surfaces. Highly efficient . . . withstands temperatures up to 1200° Fahrenheit.

6. OC Mastic Finish—An asphalt emulsion cement for insulated pipe and equipment exposed to outdoor or high moisture conditions.

7. Insulating Wool, Type TW-F—Available in bats, rolls and bulk. Used for drying-ovens, heaters, etc., for filling irregular spaces.

8. PF Insulation—Manufactured in 5 densities from 2½ to 9 lbs. per cu. ft.—standard sizes 24" x 48", 1" to 4" in thickness, according to density. For insulated panels, sound absorption and various semi-structural applications.

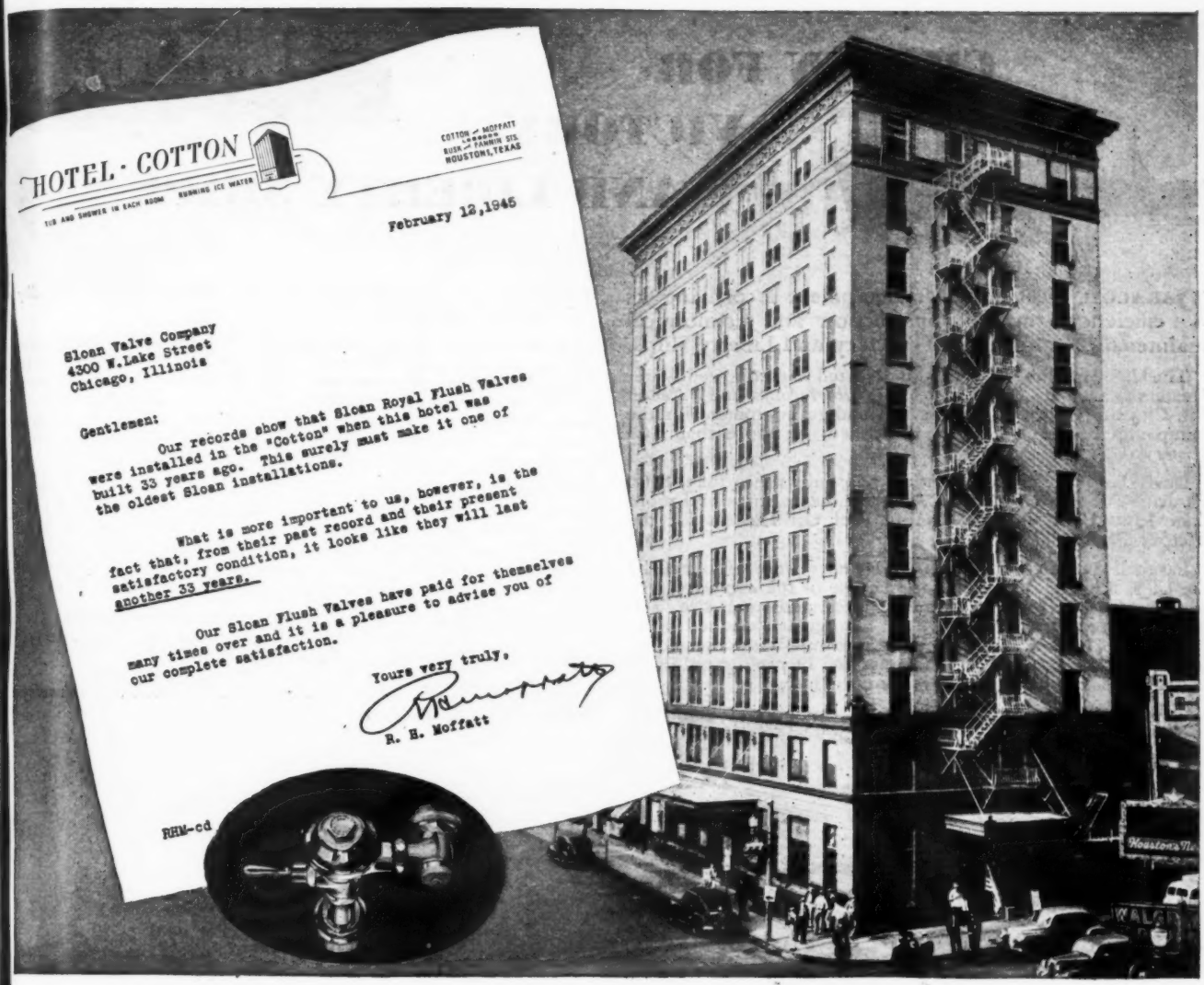
9. PF Roof Deck Insulation—9 lbs. density with facing to facilitate mopping. Highly efficient, with incombustible, rotproof and moisture-resistant core, for application under industrial built-up roofings. Sizes 24" x 48". Thicknesses from ½" to 2".

ARMY E NAVY

FIBERGLAS

*Trade Mark Reg. U. S. Pat. Off.

INDUSTRIAL INSULATIONS


HOTEL · COTTON
TUB AND SHOWER IN EACH ROOM RUNNING ICE WATER
COTTON — MOFFATT
RUSK AT TRAVIS STS.
HOUSTON, TEXAS
February 12,1945
Sloan Valve Company
4300 W.Lake Street
Chicago, Illinois
Gentlemen:
Our records show that Sloan Royal Flush Valves were installed in the "Cotton" when this hotel was built 33 years ago. This surely must make it one of the oldest Sloan installations.
What is more important to us, however, is the fact that, from their past record and their present satisfactory condition, it looks like they will last another 33 years.
Our Sloan Flush Valves have paid for themselves many times over and it is a pleasure to advise you of our complete satisfaction.
Yours very truly,
R. H. Moffatt
RHM-cd

COTTON'S SLOAN FLUSH VALVES

Now In Service for 33 Years

As in the case of the Hotel Cotton, Houston, thousands of Sloan Flush Valves have been giving excellent service for over a third of a century.

And Sloan Flush Valve "excellent service" means dependable operation—greater water economy—and maintenance costs as low as ¼ of 1c per valve per year . . . small wonder that Mr. Moffatt can say "Our Sloan Flush Valves have paid for themselves many times over."

These unequalled records of *Sloan* Flush Valve performance assure you the best and most dependable Flush Valves that money can buy for your postwar building.

That's why—there are more SLOAN Flush Valves sold than all other makes combined.

Sloan Valve Company has been awarded the Army-Navy "E" three times for excellence in production.

SLOAN VALVE COMPANY • CHICAGO 24

4300 WEST LAKE STREET

CHOSEN FOR VICTORY AND LIBERTY SHIPS

PARACOIL Heat Transfer Equipment is proving its efficiency, rugged construction and economical maintenance on scores of Victory and Liberty Ships.

The U. S. Maritime Commission selected Paracoil Feed Water Heaters as standard equipment on all *Liberty Ships,* and Paracoil Self-Cleaning Fuel Oil Heaters as standard equipment for the pump and heater assemblies illustrated, on more than 500 *Victory Ships.*

Davis Engineering Corporation has built more than 1800 Paracoil Feed Water Heaters for the Liberty Ships and more than 1500 Paracoil Self-Cleaning Fuel Oil Heaters for the Victory Ships.

Paracoil Self-Cleaning Fuel Oil Heaters were preferred by the U. S. Maritime Commission because of the exclusive self-cleaning feature, high heat transfer rates, and small size. The heating surface of these heaters can be regularly cleaned while the heater is *in operation,* an important feature not possessed by any other heat exchanger. Disconnection of piping and disassembly of heater for cleaning is *not* necessary.

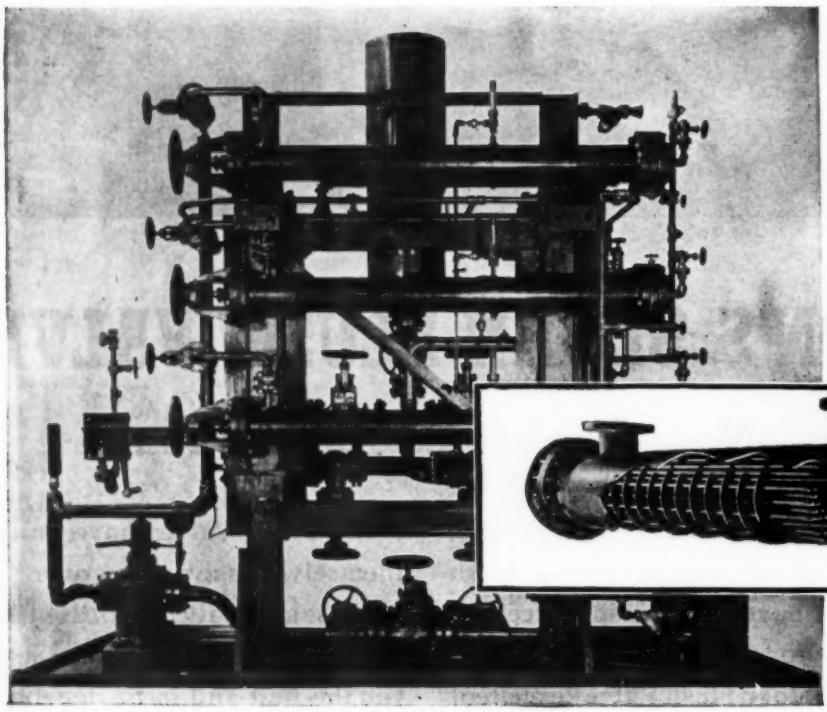
Cleaning is accomplished without the mess customarily attendant, at a saving of many man hours and without standby or duplicate equipment.

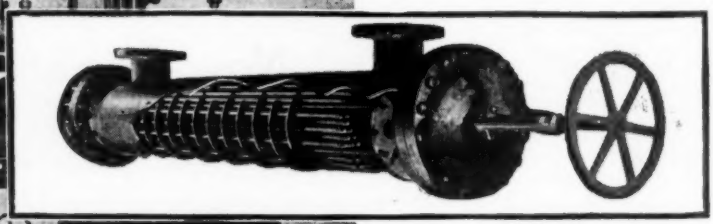
If used regularly and periodically as required by the quality of the oil and the conditions of operation, the Paracoil Self-Cleaning Device permits the elimination of fouling deposits which decrease heat transfer rates with resulting lowered oil temperatures, and in many cases, inefficient operation. In heat exchangers equipped with the Paracoil Self-Cleaning Device heat transfer rates can be maintained constant and uniform.

In both Marine and Stationary fields, Paracoil Heat Exchangers have been honored by their selection for jobs requiring the best, because of their reputation for advanced design and high quality of material and workmanship. To all industries using heat exchange equipment, the name "Paracoil" is a symbol of dependable, economical and trouble-free service.

Whatever your particular heat transfer requirement may be, our engineers are at your service to guide you in the selection of proper equipment for your conditions.

Write for Bulletin HE-100 describing the Paracoil Self-Cleaning Tubular Heat Exchanger.





VICTORY SHIP

Oil pumping and heating assembly built by Mid-West Heat Service and Peabody Engineering Corporation. Self-Cleaning Paracoil Fuel Oil Heaters by Davis Engineering Corporation.

SINCE 1915

Paracoil

HEAT TRANSFER EQUIPMENT

DAVIS ENGINEERING CORPORATION

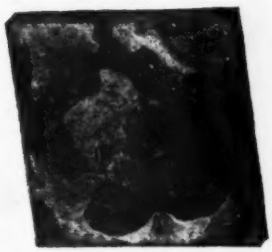
1066 EAST GRAND STREET, ELIZABETH 4, NEW JERSEY

"My high Rust I. Q.* protects metal equipment!"

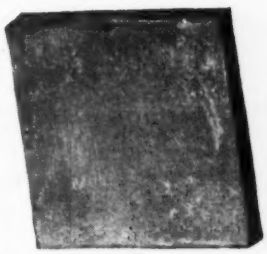
**Inhibitive Quality*

Steel Block Test proves Eagle Super "66" is rust-inhibitive!

Here is how one steel block *looked after being imbedded in a regular insulating cement during the test period. Note the extent of the rust. Such corrosion also occurs on iron and steel equipment whether heated or cold.*



The other steel block *looked like this after being imbedded in Eagle Super "66" for the same test period. Note absence of rust. This shows how effectively the rust-inhibitive qualities of Super "66" can protect your heated equipment.*



As shown by steel block test above, Eagle Super "66" . . . in addition to doing an unsurpassed job of insulating . . . actually inhibits rust! This means that hard-to-replace heated metal equipment will be better protected as well as more effective if given a coat of this unique plastic insulation.

High Efficiency Results from "Springy Ball" Structure

Eagle Mineral Wool, principal ingredient of Eagle Super "66," is made up of springy pellets containing countless dead air cells, providing highly efficient insulation. "Springy Ball" structure, created by these resilient pellets, is retained after the insulation dries, thus preserving its extremely low thermal conductivity for year-after-year heat savings.

An easy-to-use, all purpose insulation

Eagle Super "66" gives exceptional protection, and can be easily applied with equal effectiveness to almost any shape or size surface. It withstands a full range of temperatures to 1800° F., and if not used at temperatures above 1200° F., *can be removed, remixed and reused!* Dry coverage is unusually high . . . cost per sq. ft. is less than most insulating cements and blocks.

To guard Eagle Super "66" from outside damage, we recommend Eagle **INSULSEAL** . . . a tough, weatherproof coating that resists scuffs and bumps. Trowels on—dries to a hard finish. Withstands up to 450° F.

Other Eagle Industrial Products Include:

Eagle Swetchek (black). *A prepared, asphaltic base, anti-condensation compound.*

Eagle Drycote (white). *A dry, ready-to-mix, anti-condensation compound.*

Eagle "43" Finishing Cement. *A hard, white finish coating for all types of indoor insulation within a range of from 70° F. to 800° F.*

FREE MANUAL! Gives case examples of how industrial insulation effects large fuel savings. Includes Heat Loss Estimate Sheet for your use. Write for your copy.

Finish the war faster—keep on buying War Bonds!

EAGLE-PICHER INSULATIONS
High and Low Temperature

EAGLE EP PICHER

Made by THE EAGLE-PICHER COMPANY • CINCINNATI (1), OHIO

Eagle Super "66" Insulating Cement • Eagle L-T and M-2 Felt • Eagle Supertemp Block • Eagle Blankets • Eagle Pipe Covering
Eagle Insulseal • Eagle Loose Wool • Eagle Insulstic • Eagle Swetchek • Eagle Drycote

NO "GLAND TROUBLE"

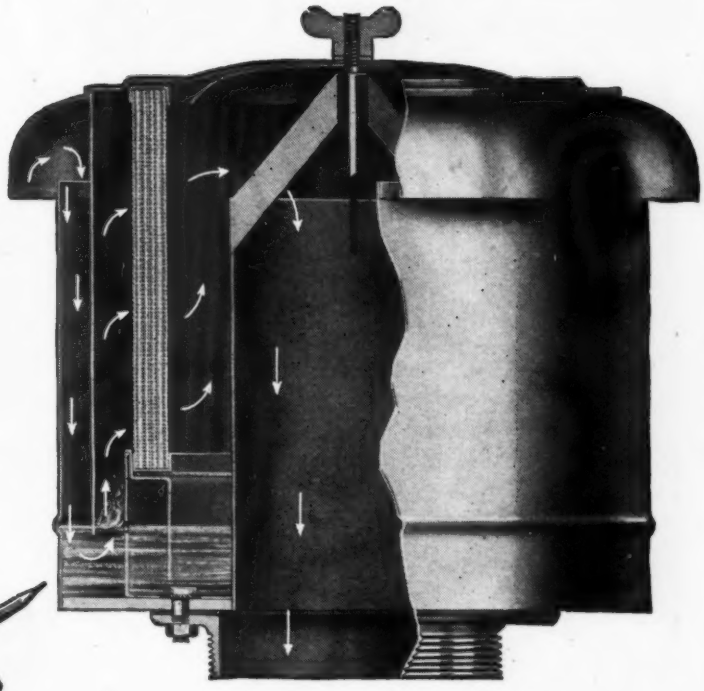
Because UNITROL level Controller has no packing glands or stuffing box

On recirculator systems of condenser hotwells, deaerators—or wherever the level of liquids must be controlled—UNITROL will do it more accurately! Simple . . . self-contained . . . this exclusive design eliminates trouble-making restrictive elements. Friction is minimized. Action is free and unhampered. Feed or drain is regulated promptly and positively. The float is linked to the inner valve through ratio connection, with maximum float travel on any size valve of only 7 inches. Available for temperatures up to 750° F.—in valve sizes ½" to 4"—integral casting construction—valve and float-cage of semi-steel or cast steel—float of seamless copper or stainless steel—and with the fine craftsmanship for which K & M has been recognized for 75 years. Our Engineering Department will be glad to make specific recommendations.

Write for General Catalog 66

KIELEY & MUELLER, INC.
MANUFACTURERS OF PRESSURE AND LEVEL CONTROLS
2001-43rd ST., NORTH BERGEN, N. J.

Awarded our employees for outstanding production achievement



Oil Bath Filter
Patented

Air Filter QUIZ

1. HOW HIGH IS THE DUST ARRESTMENT? Practically all popular filters for air intakes of engines, compressors and blowers have efficiencies ranging between 95% and 99%. But there are other important considerations in the selection of an air filter.

2. IS IT ALL METAL? All metal filters resist deterioration. Air-Maze all metal filters use a media of crimped metal screen mesh which does not "pack down", and density of media is the same throughout every square inch of filter surface. Metal filters are better able to withstand engine backfires.

3. DOES IT OPERATE ON THE VISCOUS-IMPINGEMENT PRINCIPLE? Air-Maze Filters do. They permit large air flow in small space and are not affected by moisture or oil-laden air.

IF IT USES AIR . . . USE
AIR-MAZE
ENGINEERED AIR FILTRATION
• Oil bath type filters and filter-silencers • Cleanable filter panels for air-borne oil, grease and liquids • Oil-wetted type filters and filter-silencers
• Exhaust spark arresters • Gear case, crankcase and tank vent breathers
• Oil-separators for engine crankcases • Full-flow type cleanable oil filters

4. IS IT AN OIL BATH TYPE? Most industrial applications demand the greater dirt-holding capacity and less frequent service of an oil bath filter. Air-Maze Oil Bath Filters vary in size from breather filters to large industrial units.

5. DOES IT HAVE LOW RESISTANCE TO AIR-FLOW? The advantage of low pressure drop is obvious. Because of the cylindrical design of Air-Maze Filters, the average drop in oil-wetted types is less than ⅛" w.g.; in oil bath types, less than 2" w.g.

6. CAN THE FILTER BE DISASSEMBLED AND CLEANED? A simple servicing operation restores oil-wetted filters to their original efficiency. The continuous washing action in oil bath filters keeps the filtering media clean and efficient. Air-Maze Oil Bath Filters are designed so that they can be easily and quickly disassembled and cleaned when necessary.

★ ★ ★

You get engineered filtration in every Air-Maze Filter. More than 3,000 Air-Maze products assure proper selection of the filter for special application. Your Air-Maze representative will recommend the best filter for your needs. Air-Maze Corporation, Cleveland 5, Ohio. Representatives in principal cities. In Canada: Williams & Wilson, Ltd., Montreal, Quebec, Toronto, Windsor; Fleck Bros., Ltd., Vancouver.

No pulse—

BUT PLENTY OF PUSH!

That's why the

SIER-BATH SCREW PUMP

is best for

ACETATES • ASPHALT
BUNKER C FUEL OIL
CELLULOSICS • GREASES
BRINE • SYRUPS • SOAPS
MOLASSES • FIRE SERVICE

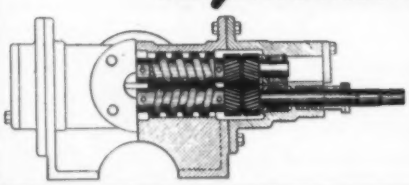
★ The absence of pulsation and vibration that characterizes the Sier-Bath Screw Pump eliminates excessive wear, prevents pipe joint loosening, reduces foundation expense. In fuel oil service, it promotes boiler efficiency because it prevents "puffy" firing and reduces tip cleaning.

The Sier-Bath quadruple-screws' powerful thrust permits handling higher viscosities with lower power consumption and smoother flow. This characteristic also cuts tank heating costs. Made in external gear type for non-lubricating fluids, internal gear type for lubricating fluids. Write for complete catalog.

☆ MANUFACTURING QUALITY PRODUCTS SINCE 1905 ☆

SIMPLICITY MINIMIZES MAINTENANCE

Only Two Moving Parts

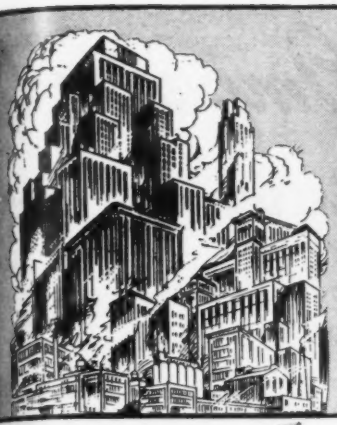


Only two moving parts. Since there is no pressure on the gland, repacking can be done while pump is running. End to center fluid movement eliminates thrust bearings. Self-centering timing gears prevent side-wear of pumping screws resulting from screw contact.

PUMP DIVISION

Sier-Bath Gear Co.

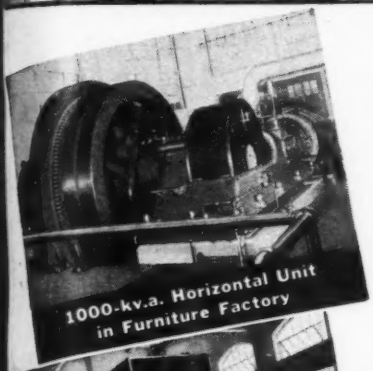
9254 HUDSON BOULEVARD, NORTH BERGEN, N. J.



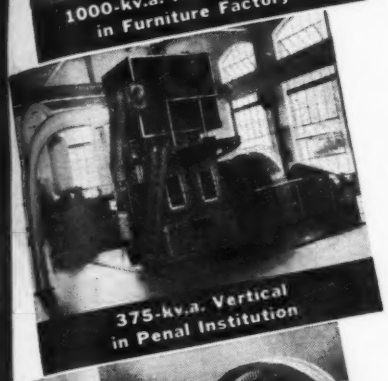
FOR MORE THAN THREE DECADES

SKINNER "UNIVERSAL UNAFLOW" STEAM ENGINES

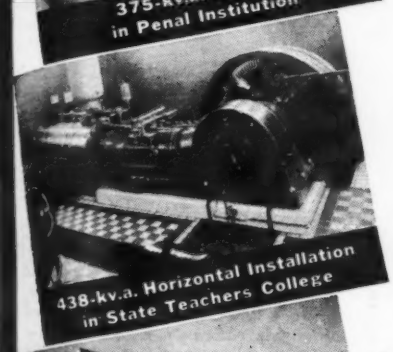
HAVE BEEN MEETING INDUSTRY'S DEMAND FOR DEPENDABLE, ECONOMICAL ELECTRIC POWER



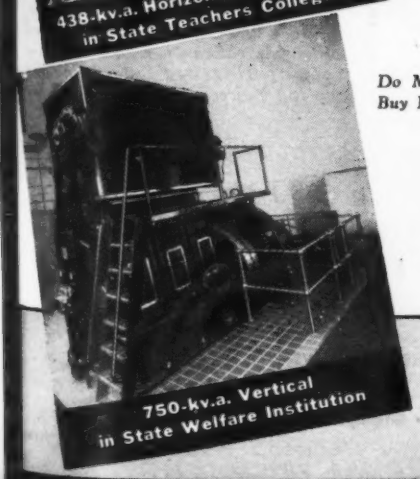
1000-kv.a. Horizontal Unit in Furniture Factory



375-kv.a. Vertical in Penal Institution



438-kv.a. Horizontal Installation in State Teachers College



750-kv.a. Vertical in State Welfare Institution

EXPERIENCE

For over three-quarters of a century, doing one thing well—building steam engines. This plant is the largest in the United States devoted exclusively to the building of steam engines, and the Skinner organization has justly acquired the reputation of being steam engine specialists.

THE "UNIVERSAL UNAFLOW"

The "Universal Unaflow" was the first American poppet-valve unaflow engine, and has earned popular recognition as "the most economical steam engine built." More "Universal Unaflow" engines have been built than all other American unaflow engines combined.

Two thousand power users, in industries and institutions of various types, have found it more economical to generate their own electric power with Skinner "Universal Unaflow" Steam Engines than to purchase power from the local utility, or to generate their power with other prime movers.

ADAPTABILITY

Suitable for noncondensing or condensing operation, with automatic change for either condition. Also may be built for constant or variable back pressures up to 30 lb.; medium or moderately high initial pressures, saturated or superheated steam.

MAINTAINED ECONOMY

Maintained economy is guaranteed, and is due to patented design of the poppet inlet and auxiliary exhaust valves, which are steam-tight after long use and under any variation of steam pressure or temperature. Steam consumption guaranteed subject to test after six months' operation, with final payment withheld until after test.

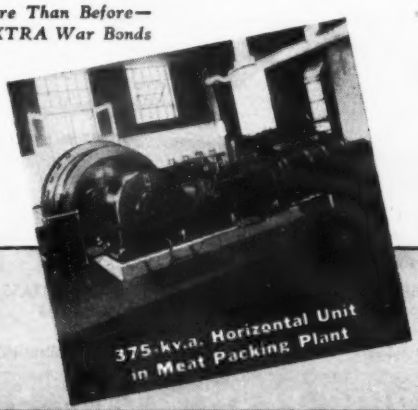
HORIZONTAL ENGINES

In general use for direct connection to electric generators, refrigeration equipment, compressors, blowers, pumps, etc. Special manual or automatic controls for variable speed and load requirements.

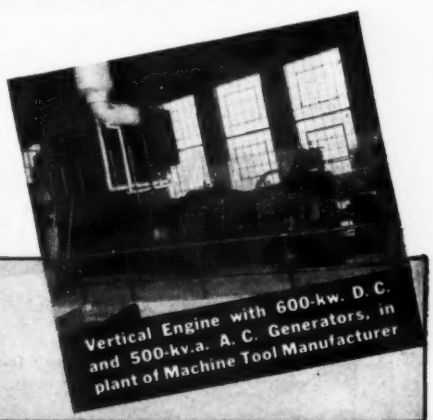
VERTICAL ENGINES

For limited space, or where other conditions make a vertical engine preferable, the stationary "Universal Unaflow" is offered in multi-cylinder vertical type, embodying the same fundamental economy and design features as the horizontal. Multi-cylinder vertical "Universal Unaflow" assemblies also extensively used for variable-speed compressor drive.

Do More Than Before—
Buy EXTRA War Bonds



375-kv.a. Horizontal Unit in Meat Packing Plant



Vertical Engine with 600-kw. D. C. and 500-kv.a. A. C. Generators, in plant of Machine Tool Manufacturer

For Over 75 Years, Doing One Thing Well—Building Steam Engines

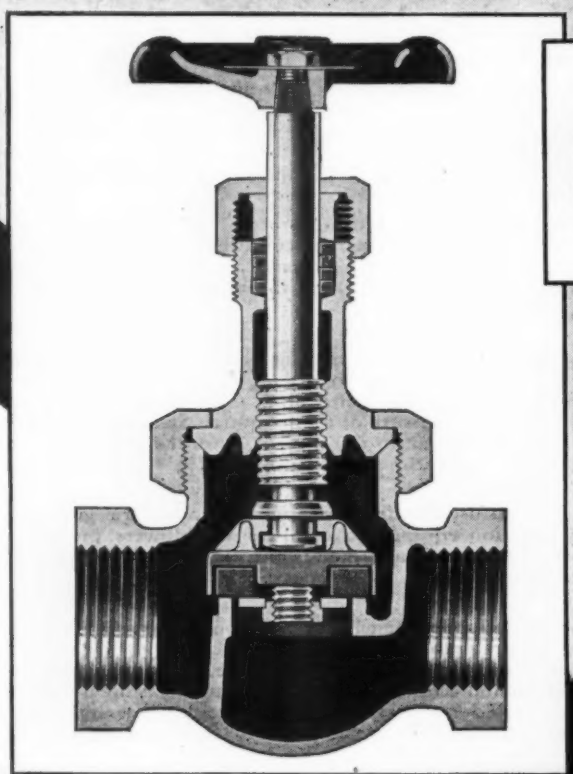
SKINNER ENGINE COMPANY, ERIE, PA.

Originated · Developed · Improved

by Reading-Pratt & Cady

● Tight, sturdy, dependable, long-lasting, adaptable to many types of service—that, briefly, describes this line of bronze globe and angle valves. The slip-on renewable disc—an **R-P&C** development—can be easily and quickly replaced. Disc inserts are of asbestos composition, rubber, leather or a special metal. These insert rings are renewable separately and are of standard size—therefore, interchangeable. Union bonnet construction, with bevel between body and hub, still further simplifies the servicing of these globe and angle valves.

We suggest that you get an **R-P&C** recommendation next time you need valves.



Slip-on renewable disc with insert

R-P & C offers you a single responsible source for bronze, iron and steel gate, globe, angle and check valves—cocks and lubrotile gate valves—bar stock valves—cast steel fittings—d'Este Automatic Regulating Valves.

READING-PRATT & CADY

MANUFACTURERS OF
READING CAST STEEL VALVES AND FITTINGS • PRATT & CADY BRASS AND IRON VALVES
D'ESTE AUTOMATIC REGULATING VALVES

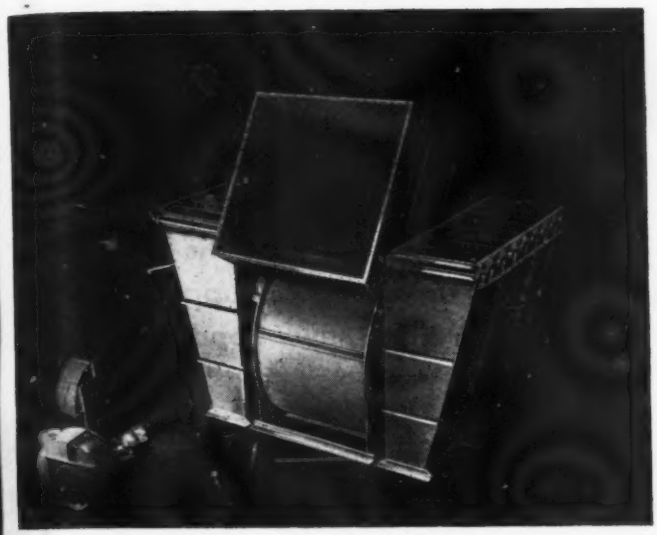
ACCO

Reading, Pa. • Atlanta • Boston • Chicago • Denver • Houston • Los Angeles • New York • Philadelphia • Pittsburgh • San Francisco • Bridgeport, Conn.

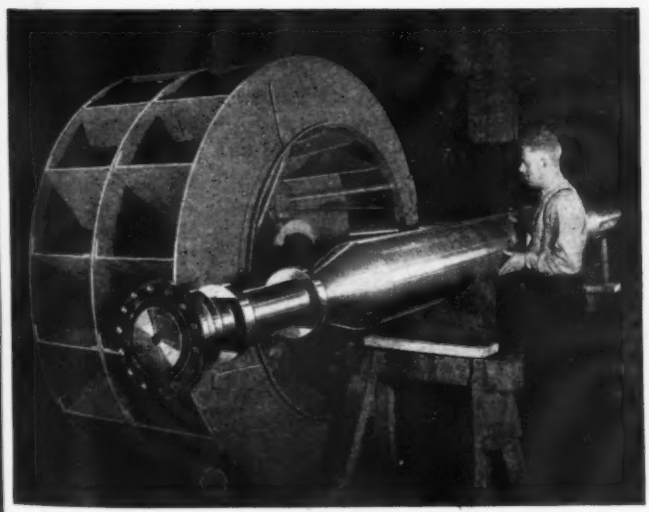
READING-PRATT & CADY DIVISION
AMERICAN CHAIN & CABLE

TRADE MARK

CINDERS at Hurricane Speed pack a WALLOP



Huge "Buffalo" Induced Draft Fan ready to take years of punishment.



Mighty Rotor and Shaft of "Buffalo" Induced Draft Fan showing thick steel plates and blades.

...that's why "Buffalo" INDUCED DRAFT FANS are built to TAKE IT!

Drawing high-velocity storms of ashes from boiler fire beds year after year without let-up, Induced Draft Fans just *have* to be extra *tough* to stand the persistent erosion. That's why "Buffalo" rotors are designed with extra heavy blades and plates hot-riveted together for solid endurance . . . why they're designed to operate with MAXIMUM efficiency at moderate speeds for added years of practically attention-free service. When new rotors are finally necessary, "Buffalo" housings are easily "taken down" for speedy replacements! For complete description of "Buffalo" Induced Draft Fans, write for Bulletin 3190-B.

ARMY E NAVY

BUFFALO FORGE COMPANY

488 BROADWAY — BUFFALO, NEW YORK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

"Buffalo" INDUCED DRAFT FANS

AS IMPORTANT AS OIL ITSELF!

DE LAVAL OIL PURIFIERS make possible to a maximum degree the one thing as important in prime mover lubrication as an adequate supply of proper oil—the means of maintaining that oil in "like-new" condition.

BECAUSE - De Laval Oil Purifiers effect purification entirely by means of a constant centrifugal force. From the start of a run until the bowl is filled with dirt, the same centrifugal force acts on the oil. This "constant efficiency" feature assures a maximum removal of solid impurities or dirt . . . and the simultaneous continuous removal and discharge of moisture leaves the oil so clean and dry that it is the finest protection any bearing or moving part can be given.

The De Laval centrifugal helps maintain in any oil the properties given it at the refinery. . . . When oil is circulated on continuous by-pass, through De Lavals of proper capacity, it is purified from three to four times daily. Either a De Laval Oil Purifier by itself, or in the case of turbines, a complete De Laval-Funk Process, will continuously keep the oil so pure that failures chargeable to impure lubricating oil are entirely ruled out.

● Write for additional information.

ADVANTAGES OF DE LAVAL LUBRICATING OIL PURIFIERS

Constant high purifying efficiency—without renewal of functional parts

•

Economical to operate

•

Remove both enemies of good lubricating oil performance: water and dirt

•

Provide maximum protection to power units

•

Give long, trouble-free service

•

Lower maintenance costs

•

Maintain oil in condition most nearly identical with that of new oil

•

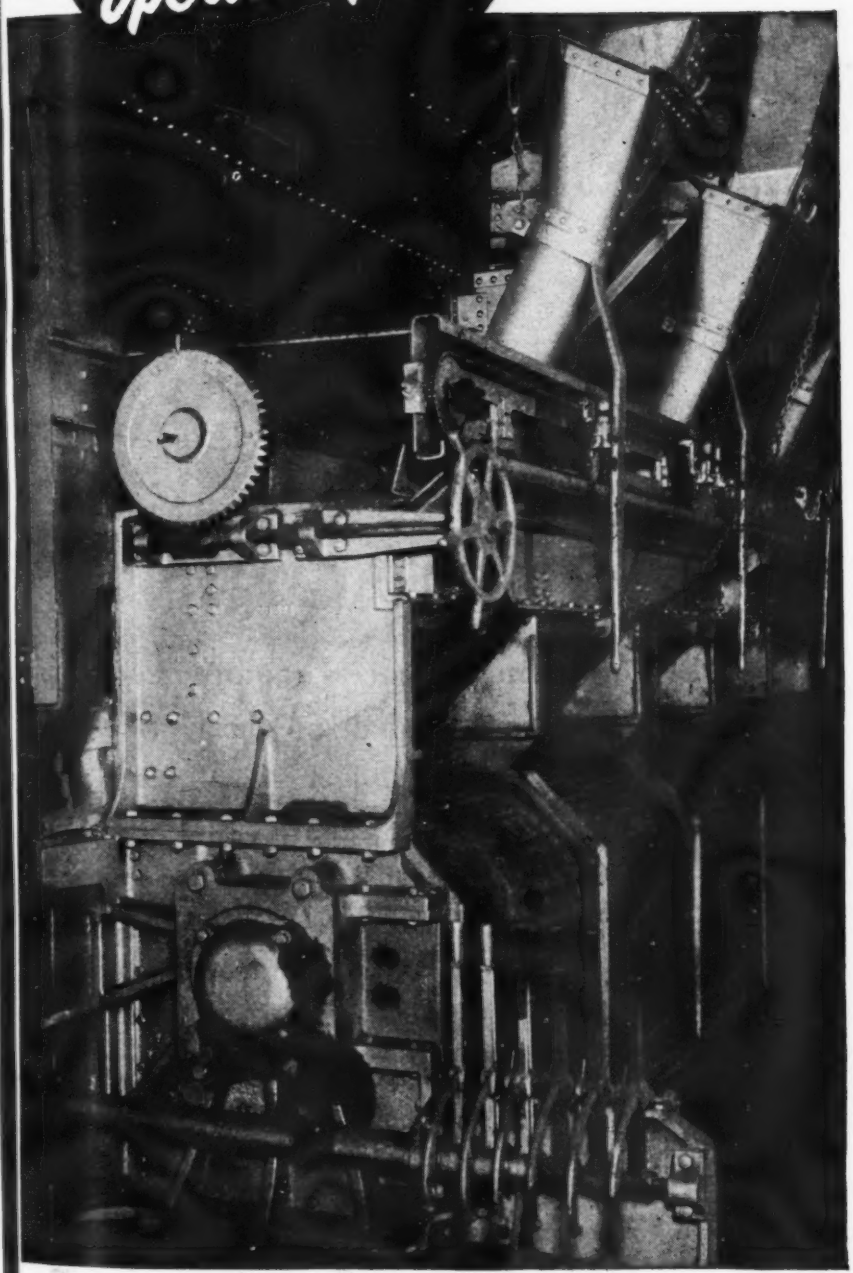
Self-draining purifier bowl makes for easy cleaning

DE LAVAL

THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 6 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 19
THE DE LAVAL COMPANY, Limited
MONTREAL PETERBOROUGH WINNIPEG VANCOUVER

LUBRICATING OIL PURIFIERS

5 WAYS *to lower operating costs* assured with "CARBOFRAX" brick-protected settings



In several thousand installations, "CARBOFRAX" silicon carbide brick have demonstrated their economy by—

- **Increasing** steaming capacity.
- **Eliminating** frequent shutdowns for lining repairs.
- **Improving** combustion conditions.
- **Reducing** labor costs.
- **Cutting** refractories expense.

Remember that a "CARBOFRAX" brick setting is a dependable setting. In either stoker or hand-fired boilers, "CARBOFRAX" brick assure efficient and economical operation. Write now for more information on this super refractory by "CARBORUNDUM" and its application to your boiler furnaces.

THE CARBORUNDUM COMPANY
Dept. J-4
Refractories Division
Perth Amboy, New Jersey

"CARBORUNDUM" and "CARBOFRAX" are registered trade marks of, and indicate manufacture by, The Carborundum Company.

Super Refractories by **CARBORUNDUM**

CONFIDENCE

MAY SOMETIMES BE MISPLACED

BIRD-ARCHER

promises *ONLY* what can actually be accomplished

Intelligent . . . modern complete service in

INDUSTRIAL WATER CONDITIONING

for steam or process requirements based on knowledge, experience, research and chemical laboratory analysis.

Write for our latest booklet on Water Testing Equipment for Power Plants and Methods of Procedure

Consultation . . . without obligation

THE BIRD-ARCHER CO.

NEW YORK 17, N. Y. • CHICAGO 11, ILL. • PHILADELPHIA 40, PA. • MONTREAL, CAN.

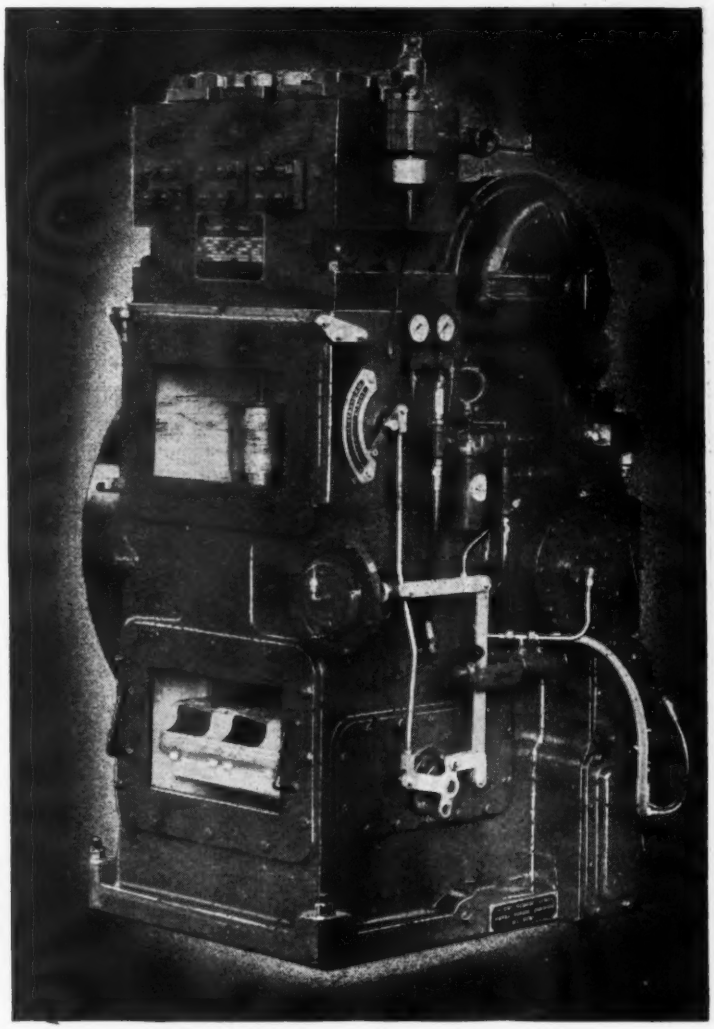
SURVEYS • PLANT STUDIES • CONSULTATIONS • TREATMENTS

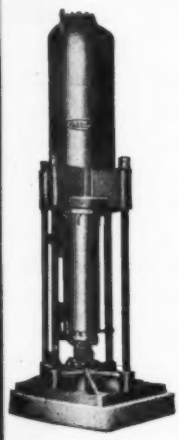
PLANT DESIGN • SUPERVISORY SERVICE • LABORATORY SERVICE

. . . THERE IS AN

ALDRICH PUMP

for every HYDRAULIC SERVICE . . .





The Aldrich-Groff Controllable Capacity Pump (*above, right*). A variable stroke vertical triplex pump fitted with automatic control mechanism to deliver from 0 to 100% rated capacity at constant pump and motor speed. Control of rate of delivery can be accomplished from any remote point, manually or automatically. Will handle any free-flowing liquid at discharge pressures from 200 to 15,000 p.s.i. In sizes ranging from 5 to 100 HP.

Aldrich-Groff Pumps can also be furnished in a constant-stroke type with variable speed (d.c.) motor.

Aldrich Inverted Vertical Triplex Pump (*above, left*). A high pressure constant-stroke pump. Drive arrangements can be direct through gear-head motor as shown, through built-in pump gearing from extended pinion-shaft, or by chain, flat or V-belt from extended crankshaft. Can be fitted with Aldrich Patented Synchronized Suction Valve Control for services on hydraulic systems.

- Other Vertical Triplex Pumps with various forms of drive from 2½ to 400 HP and working pressures up to 15,000 p.s.i. built for long life under the severest operating conditions.

- Also, Aldrich Accumulators in various designs to meet any requirements; hydro-pneumatic plunger and piston types (*shown left*); dead weight or gravity types. Alleviators; Synchronized and non-synchronized suction valve controls.

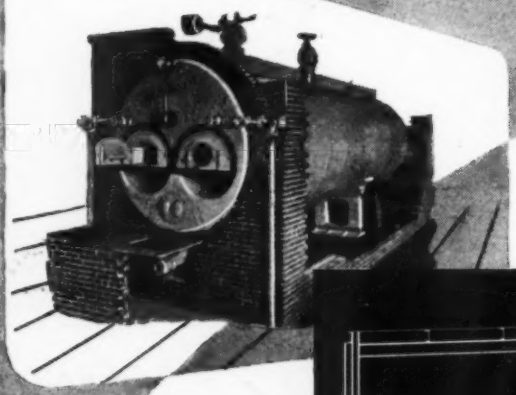
Our engineering department will gladly consult on all pumping and hydraulic problems. Bulletins and data sheets of any type pump in the Aldrich line will be sent on request.

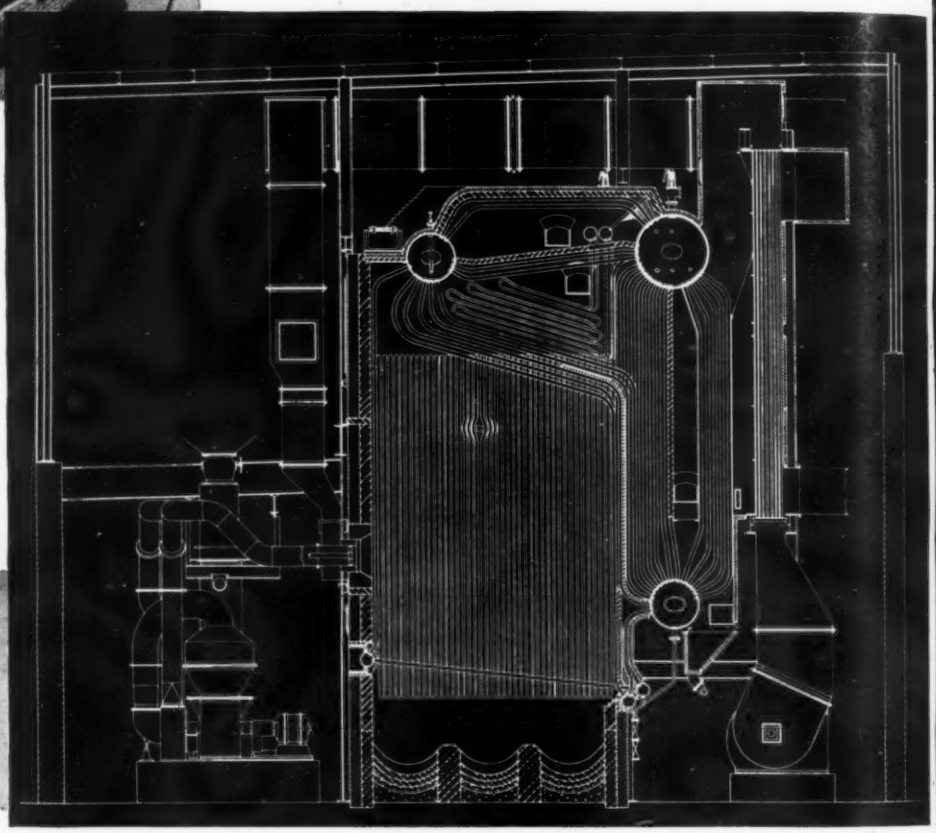
THE ALDRICH PUMP CO. ALLENTOWN • PENNA.

Representatives: Birmingham • Bolivar, N. Y. • Boston • Chicago • Cincinnati • Cleveland • Denver • Detroit Duluth • Houston • Los Angeles • Pittsburgh • Portland, Ore. • St. Louis • San Francisco • Seattle • Tulsa

Edge Moor
water tube boilers—

The Edge Moor Improved Galloway Boiler of the 1880's. It was described as "an internally fired boiler with two furnaces, uniting into one common central flue, which flue contains numerous conical tubes that cross the flue in nearly vertical lines."





Edge Moor radiant heat unit arranged for pulverized coal or liquid fuel firing. Equipped with superheater and Edge Moor vertical tubular air preheater. Capacity 75,000 lbs. steam per hour; Drum Pressure 665 psi; Degrees of Superheat 210° F.; Final Steam Temperature 700° F.

Down through the years since 1878, Edge Moor has continued to contribute to the store of knowledge and experience gained in the building of steam generating equipment. Modern demands are for continuous service and high ratings with maximum operating efficiency. Edge Moor meets these demands through a combination of skillful design, carefully selected materials and unsurpassed workmanship.

Edge Moor boilers are built in all standard designs of any required capacity, for drum pressures up to 900 lbs., and adapted to all methods of firing both solid and liquid fuels. Auxiliaries include water cooled furnaces, superheaters, economizers, air preheaters and steam washers. Complete installation service is available.

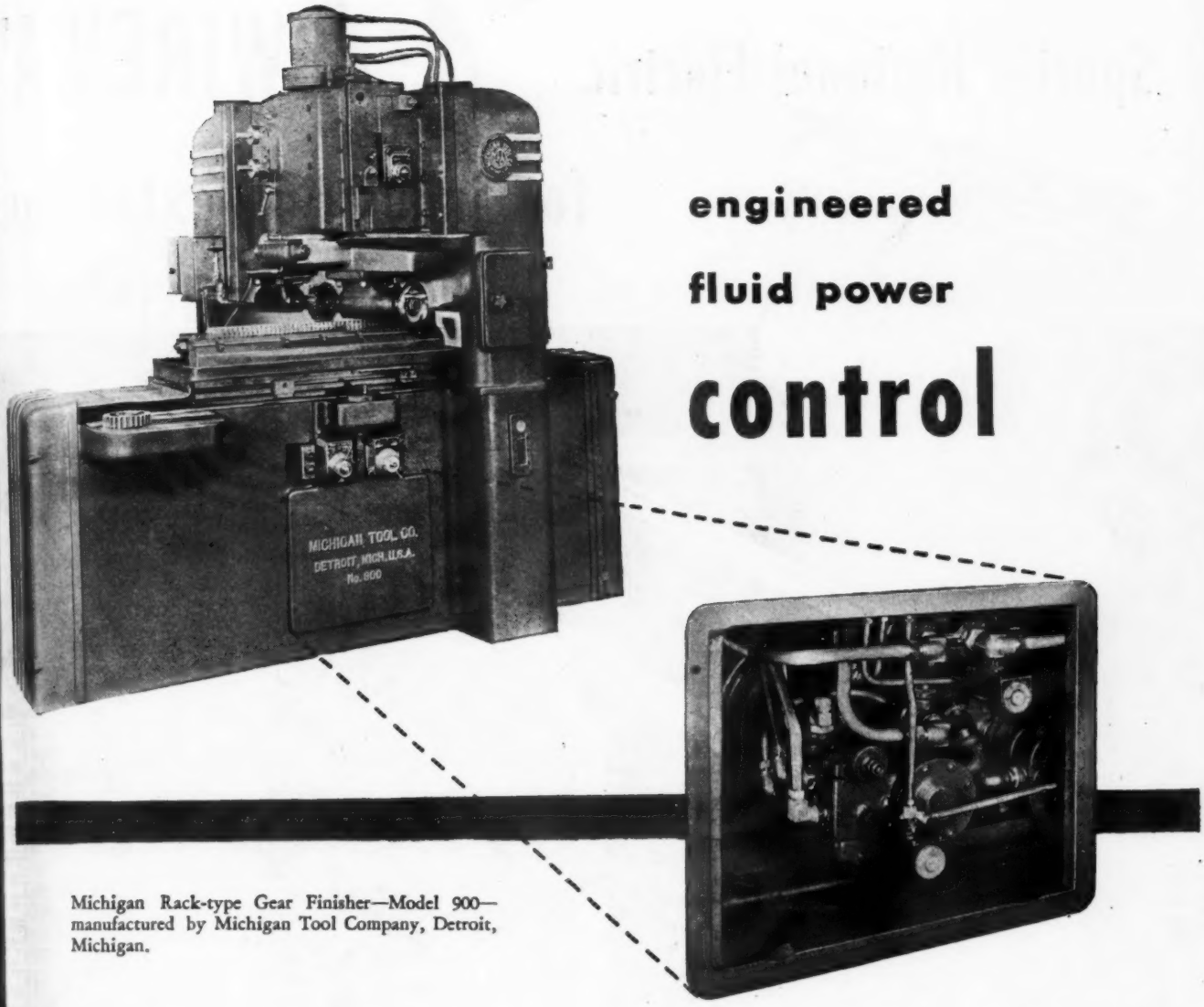
Inquiry as to Edge Moor's recommendations for your particular requirements will be given careful study, and complete proposals will be promptly submitted.

STEAM GENERATING EQUIPMENT

EDGE MOOR IRON WORKS, INC.

BRANCH OFFICES: NEW YORK 20, N. Y.: 30 ROCKEFELLER PLAZA
CHICAGO 2, ILL.: ONE NORTH LA SALLE STREET

MAIN OFFICE AND WORKS: EDGE MOOR, DELAWARE



engineered fluid power control

Michigan Rack-type Gear Finisher—Model 900—manufactured by Michigan Tool Company, Detroit, Michigan.

The hydraulic controls which make this machine—and millions of others perform with such reliability—call for tubing systems based on the principles of Fluid Power Engineering.

When properly engineered and built, these systems have certain "must" features—

1. They streamline the flow of fluids. This permits adequate response to control with minimum system capacity.
2. They make minimum demands on the power source—an economy feature.
3. They fit into the available space, even when space is limited and cramped.
4. They are planned for easy accessibility to all parts—for service and maintenance.
5. They have the smallest number of joints and connections—all leakproof—even under high pressure, vibration or abuse.

FLUID POWER engineered systems—with Parker valves, fittings and fabricated tubing meet these requirements. They are backed by more than twenty years of "know-how".

If you plan to use Fluid Power—if you need tubing installations for any purpose—ask a Parker engineer for recommendations. The Parker Appliance Co., 17325 Euclid Ave., Cleveland 12, Ohio. Booklet on request.

THE

PARKER

APPLIANCE COMPANY

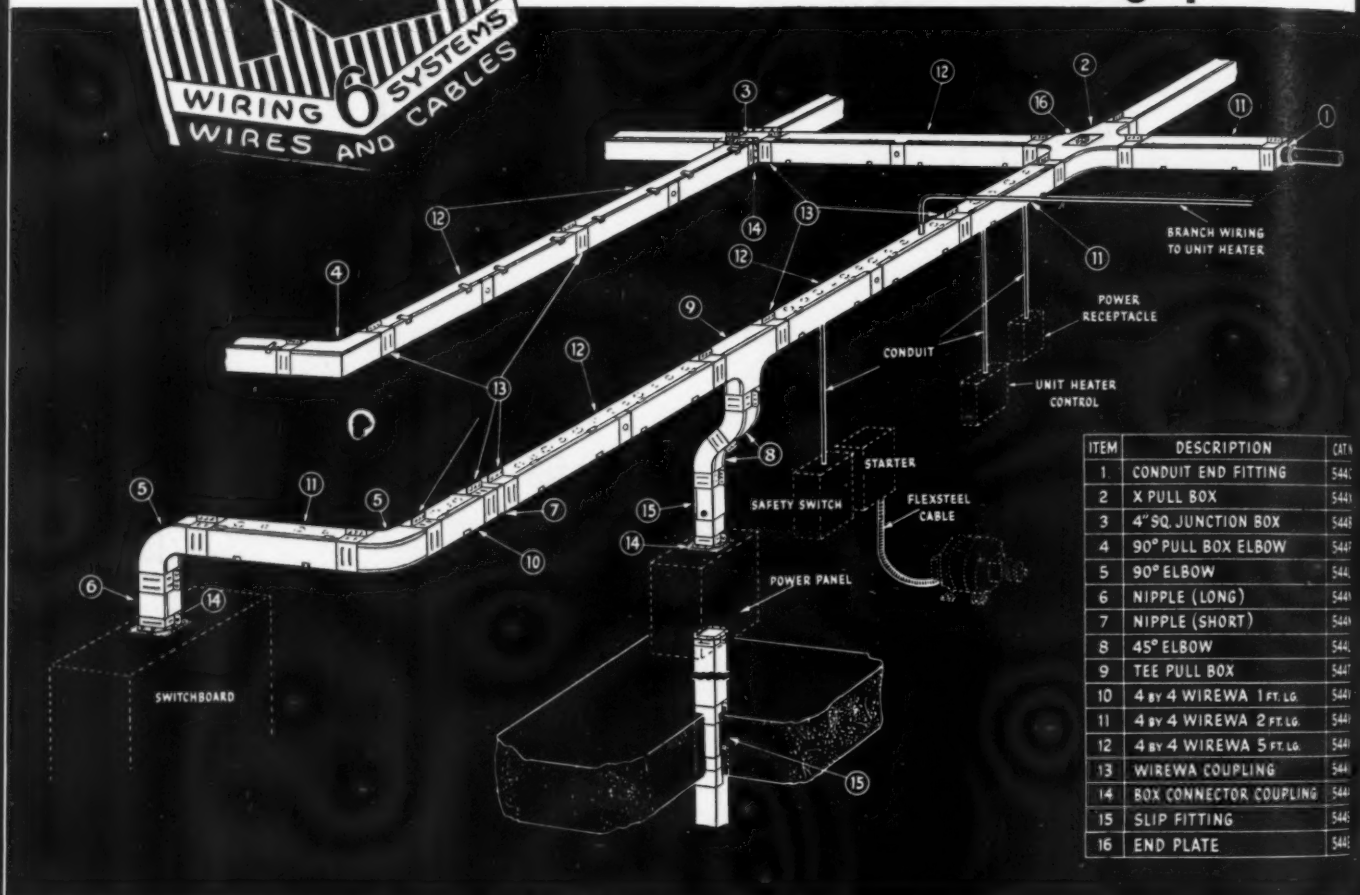
CLEVELAND • LOS ANGELES

FLUID POWER ENGINEERING

Specify National Electric "4 x 4 WIREWA"

for industrial extensions and rewiring jobs

NATIONAL ELECTRIC PRODUCTS
WIRING SYSTEMS
WIRES AND CABLES



ITEM	DESCRIPTION	CAT.
1	CONDUIT END FITTING	544
2	X PULL BOX	544
3	4" SQ. JUNCTION BOX	544
4	90° PULL BOX ELBOW	544
5	90° ELBOW	544
6	NIPPLE (LONG)	544
7	NIPPLE (SHORT)	544
8	45° ELBOW	544
9	TEE PULL BOX	544
10	4 BY 4 WIREWA 1 FT. LG.	544
11	4 BY 4 WIREWA 2 FT. LG.	544
12	4 BY 4 WIREWA 5 FT. LG.	544
13	WIREWA COUPLING	544
14	BOX CONNECTOR COUPLING	544
15	SLIP FITTING	544
16	END PLATE	544

(sketch of a 4x4 WIREWA installation showing complete flexibility, simplicity and use of fittings.)

For housing of plant power systems and extension and rewiring of lines up to 600 volts, specify National Electric 4x4 WIREWA. Complete, easy to install, providing an area of 16 square inches and permitting an unusually high degree of flexibility and accessibility, this system has found wide acceptance in a variety of plants. Write for descriptive literature. National Electric also manufactures a complete line of wires and cables—famous for their long service and saving of space.

A FEW MAJOR REASONS WHY THE NATIONAL ELECTRIC 4 x 4 SYSTEM IS SO POPULAR

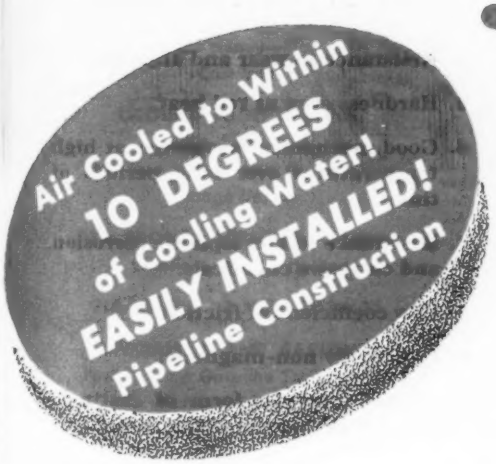
- Maximum usable space permitting greatest number of wires.
- Ease of installation and accessibility for tapping, rerouting, etc., without disturbing existing installation.
- Greater flexibility to meet specific local conditions.
- May be mounted direct to wall or by means of standard hangers suspended from the ceiling.

National Electric Products Corporation
Pittsburgh, Pa.

Eliminate DAMAGING WATER and OIL from Your Compressed Air Lines

WITH

ADAMS AFTERCOOLERS and CYCLONE SEPARATORS



ADAMS equipment insures a constant supply of cool, moisture-free, oil-free air to power your compressed air tools with the highest efficiency and safety . . . at the *lowest* installation and maintenance cost.

ADAMS AFTERCOOLERS are *guaranteed* to cool air to *within 10 degrees* of your cooling water. This means *extra* thoroughness in condensing water and oil vapors from your compressed air.

NO FOUNDATION or other facilities are required for installation. The Adams "pipeline" construction permits the After-cooler and Cyclone Separator to fit right into a section of the pipe line . . . either vertically or horizontally!

CYCLONIC SEPARATION is the Adams principle . . . engineers agree that it is *far more efficient* than other mechanical separation!

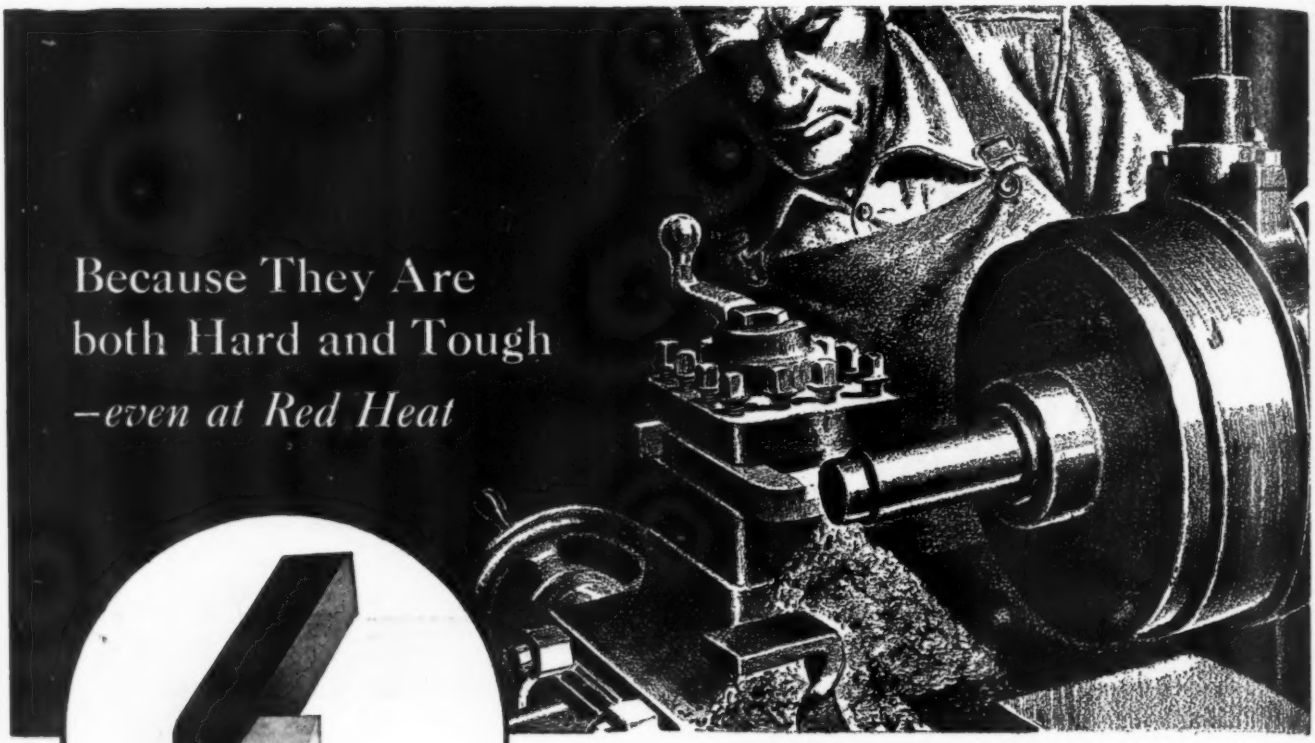
WRITE!

today for full engineering data on improved pneumatic power performance. Ask for Bulletin 703.

R. P. ADAMS CO., INC.

67 Chicago St., Buffalo, N. Y.

ADAMS AFTERCOOLERS and CYCLONE SEPARATORS



Because They Are
both Hard and Tough
—even at Red Heat

One style of HAYNES STELLITE tipped tools.

HAYNES STELLITE alloys are good materials for high-production metal-cutting tools

• **Metal-cutting tools of HAYNES STELLITE cobalt-chromium-tungsten alloys are especially economical when high speeds with heavy feeds and deep cuts are required. With these tools manufacturers have made marked savings in time and in cost per piece machined where cutting tools cannot be "babied."**

The same properties that make these HAYNES STELLITE alloys so useful in metal-cutting tools are also required in many other industrial applications where hard, tough, abrasion- and corrosion-resistant materials are needed. Our engineers can help you use the alloys economically and effectively. Write for further information.

Some Advantages of HAYNES STELLITE Alloys

1. **Resistance to wear and abrasion.**
2. **Hardness even at red heat.**
3. **Good mechanical properties at high temperatures over long periods of time.**
4. **Resistance to atmospheric corrosion and corrosive chemicals.**
5. **Low coefficient of friction.**
6. **Practically non-magnetic.**
7. **Available in the form of castings, small sheets, and welding rod.**

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HAYNES STELLITE COMPANY

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ABRASION- AND CORROSION-RESISTANT ALLOYS

"Haynes Stellite" is a registered trade-mark of Haynes Stellite Company

Here's the Answer

THE FLAGGSEAL SILBRAZ* JOINT

for a permanent Leakproof connection

Flagg Fittings include:

MALLEABLE IRON FITTINGS
Standard—A.A.R.—Extra Heavy Refinery

CAST IRON SCREWED FITTINGS
Standard — Extra Heavy

DRAINAGE FITTINGS
Short Turn — Long Turn

FLANGE UNIONS — FLANGES
Standard—Extra Heavy—Malleable and Cast Iron

GROUND JOINT UNIONS
150—250—300
"Red Ring" Three-part Ground Joint Flange Unions

RED BRONZE SCREWED FITTINGS
Standard — Extra Heavy

FLAGGSEAL BRONZE FITTINGS

SPECIALTIES AND CASTINGS
Fuel Oil and Gasoline Tank Fittings
Malleable Castings

FLAGGSEAL fittings are the last word for joining I.P.S. copper tubing and brass pipe into permanent leakproof pipe lines. They make a connection that's vibration-proof, corrosion resistant — one that will not creep . . . a connection that literally joins with the pipe to form a "one piece, maintenance-free pipe line".

No special skill is required for installing Flaggseal fittings. Anyone, after a few minutes' instruction, can make a perfect joint every time. Why? Because every Flaggseal fitting has a ring of silver brazing alloy incorporated in each port. This alloy, when heated with an oxyacetylene torch, makes a Silbraz* joint that is stronger than either the pipe itself—or the fitting. No guesswork—the right brazing alloy, in the right quantity is assured at all times. Simple . . . easy . . . quick—just assemble and heat.

Try Flaggseal fittings on your next job. Gain their time-saving advantages—plus the assurance of a perfect joint. For full information, write for a free copy of Catalog. Address: Stanley G. Flagg & Company, Inc., 1421 Chestnut Street, Philadelphia 2, Penna.

**Patented-Reg. U. S. Pat. Off.*

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FLAGG FITTINGS

SINCE 1854

MALLEABLE IRON FITTINGS • CAST IRON SCREWED FITTINGS • DRAINAGE FITTINGS
FLANGE UNIONS • FLANGES • GROUND JOINT UNIONS • RED BRONZE FITTINGS
FLAGGSEAL BRONZE FITTINGS • SPECIALTIES AND CASTINGS

How Thousands of Gasket Improvements are being effected by Fel-Pro Developments in Thiokolized Gaskets

For that New Design...or Re-Design! *Investigate Today* the 2 BIG ADVANTAGES resulting from Fel-Pro's Pioneering Development and Production of Thiokolized and other specially treated Gasket Materials.

Through Thiokolizing by specially developed Fel-Pro processes and other treatments of such gasket materials as Felpak, Karropak, Fishpaper, Chipboard, Fibre, Cork and others . . . a host of new, improved gaskets are being produced for thousands of America's leading manufacturers.

The resulting gaskets are often revolutionary in their performance characteristics as applied to specific product requirements. Most of these gaskets were developed originally to meet a specific specification . . . the need of a car builder for a more durable, oil resisting gasket . . . the requirement of an electrical device maker for a similiar material with high insulating and sealing qualities . . . the need of an auto accessory maker for an oil resisting gasket with tremendously high tensile strength . . . etc.etc.

Fel-Pro not only has the Know-How, resulting from years of experience, to provide the proper gasket for your requirements, (that's advantage 1) but also (advantage 2) the PRODUCTION KNOW-HOW to produce them ECONOMICALLY and to highest quality standards. ***Write Today for*** **FREE PORTFOLIO OF LATEST SEALING MATERIALS** ***and further details of our*** **NO CHARGE CONSULTATION SERVICES.**

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Send me, without obligation, FREE PORTFOLIO of SEALING MATERIALS and details on your NO CHARGE CONSULTATION SERVICE.
NAME
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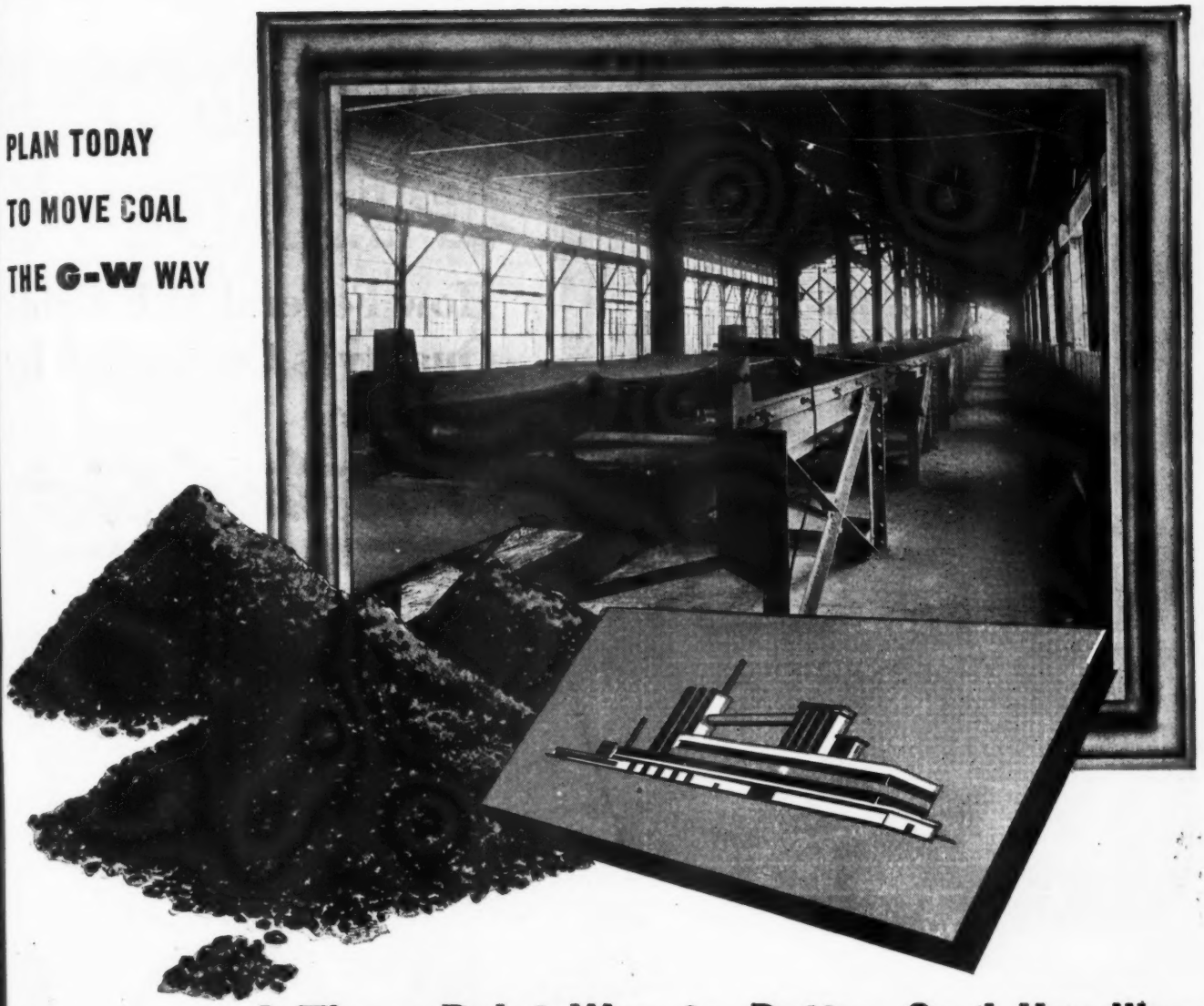
PLAN TODAY
TO MOVE COAL
THE G-W WAY



A Three-Point Way to Better Coal Handling

There are three main factors in planning coal handling systems — *speed . . . space . . . cost.*

Time consumed in conveying coal from *point of receipt,* to *point of storage,* to *point of use,* demands careful consideration to determine the fastest method. Space to be occupied for storage should be conserved to the minimum required for continuous, active supply and ample reserve stockpile. Initial, maintenance, and operation costs are determined by soundness of design, dependability of materials, and quality of workmanship.

Gifford-Wood takes all three factors into consideration when adapting conveyors, carriers, skip hoists and elevators to specific installations. Where standard G-W equipment does not fit requirements, complete new equipment and arrangements are designed, built and installed . . . all to the traditional G-W reputation for ruggedness, long service and high quality materials . . . earned through more than 130 years' experience in serving the handling requirements of nearly every industry. When you revise your method of moving coal in — and moving ashes out — plan to do it "The G-W Way". Gifford-Wood Co., 420 Lexington Avenue, New York 17, N. Y.; 565 West Washington Street, Chicago 6, Ill. Factory — Hudson, N. Y.

DO YOU KNOW? G-W maintains the complete facilities of a well-organized, manufacturing plant . . . pattern shop, machine shop, steel, forge, paint and inspection shops . . . fully equipped with modern machinery for handling all general contract work.

G-W HANDLES IT
Faster · Easier · Cheaper

GIFFORD-WOOD
SINCE 1814

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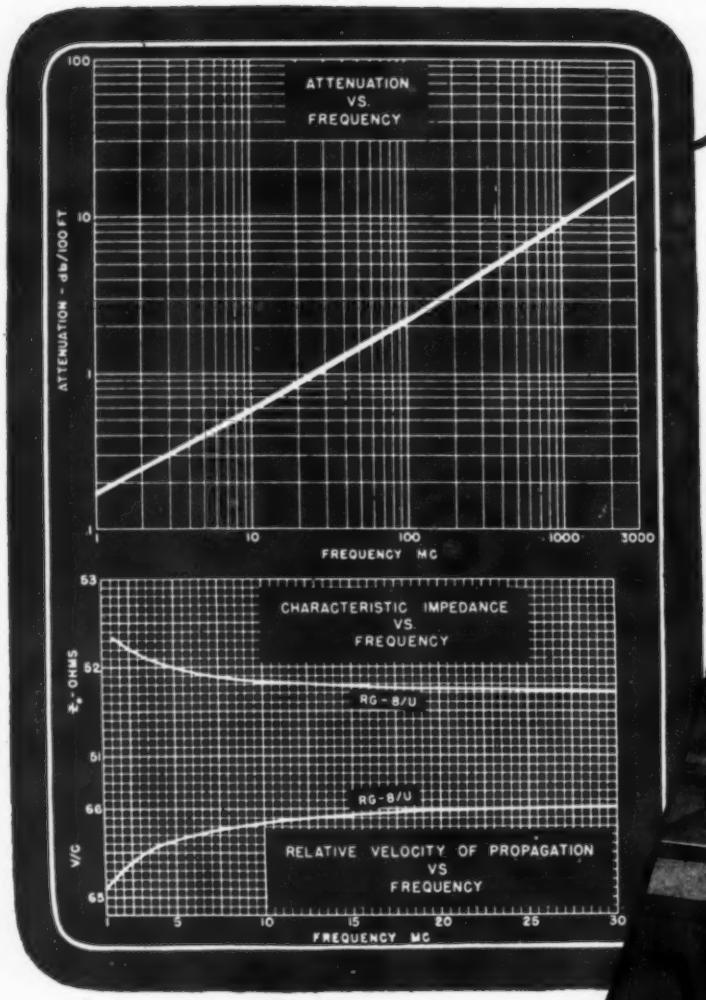
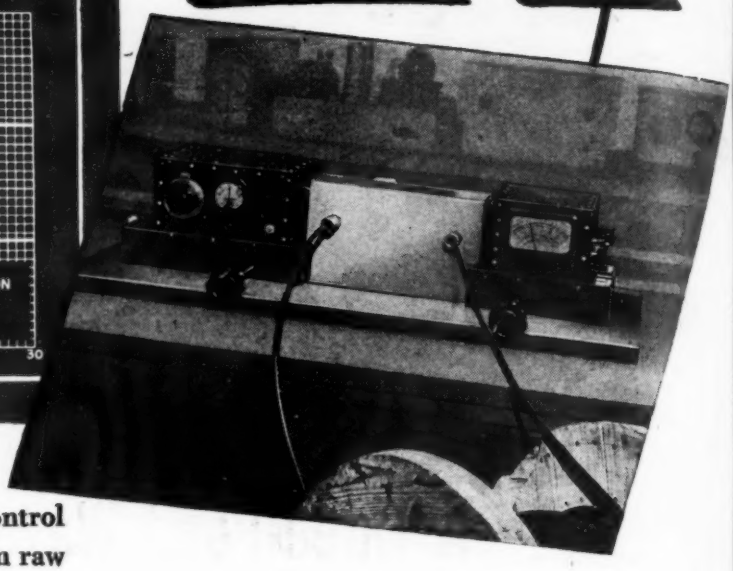


HERE'S PROOF...

How Federal H-F Cable Quality is Controlled by *Actual Test*



Precision engineering—plus careful control of all manufacturing operations... from raw materials to finished product—mean complete reproducibility in any given Intelin Cable type... and overall superior cables.

Take Intelin RG-8/U for instance... general purpose "work-horse" of high-frequency cables. Its characteristics are shown in curves obtained—not from nominal design values—but from thousands of actual measurements on cable samples, with special equipment developed and used exclusively by Federal's Intelin Product Line.

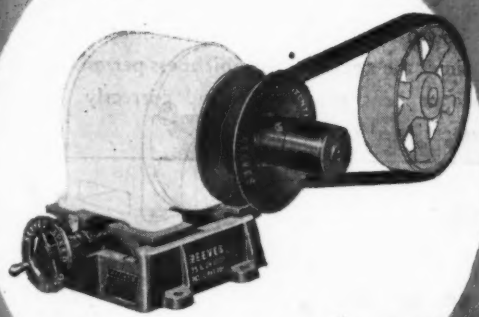
Intelin's Attenuation Meter is an example of such equipment. It's a precision instrument... accurate to .1 db... developed by Intelin to provide a constant check on production quality and "measured" data for the equipment designer.

For additional information regarding Intelin RG-8/U... write *today* for Report E-53—and for cable you can count on... *always* specify INTELIN.

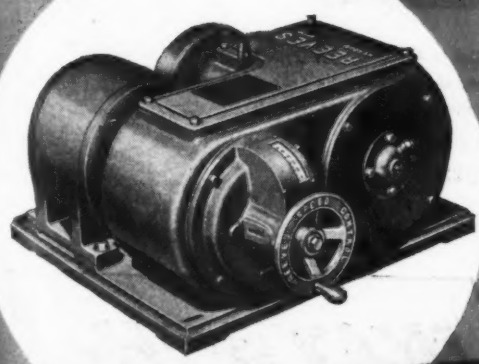
FEDERAL TELEPHONE & RADIO

Federal Telephone and Radio Corporation

VARIABLE SPEED TRANSMISSION for providing infinite, accurate speed adjustability over wide range—2:1 to 16:1 inclusive. In sizes to 87 h.p.



VARI-SPEED MOTOR PULLEY converts any standard constant speed motor to a variable speed drive within 4:1 ratio. In sizes to 15 h.p.



MOTODRIVE combines motor, speed varying mechanism and reduction gears in single unit. Sizes to 15 h.p. in ratios of speed variation from 2:1 to 6:1

these 3 units

MADE INDUSTRY SPEED CONTROL MINDED

Stepless, variable speed control has proved itself such a big factor in faster, more accurate and more economical war production that manufacturers will never again be satisfied with machines with fixed speeds. And here, illustrated on this page, are the three basic REEVES Speed Control units which have had most to do with this important development. More than 300,000 REEVES units are now in service. They are standard equipment on 1,866 different makes of machines.

No other speed control offers so many sizes and types to choose from—is so fool-proof and reliable. No other has the nation-wide staff of representatives, so thoroughly trained in this specialized field of engineering. Look for the familiar REEVES handwheel on any new machine you buy. It is your assurance of greater versatility, uniform quality and larger output of production. Easily installed, too, on any driven machine in service. Write for Catalog P-450.

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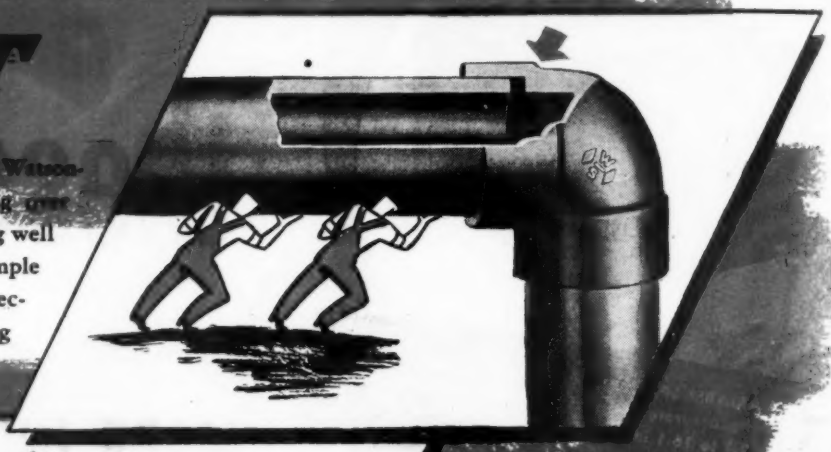
Recognized Leader in the Specialized Field of Speed Control Engineering

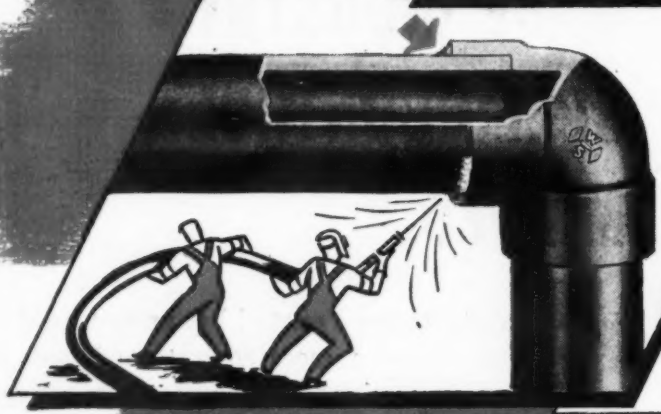
REEVES Speed Control

How to make permanently tight leak-proof joints

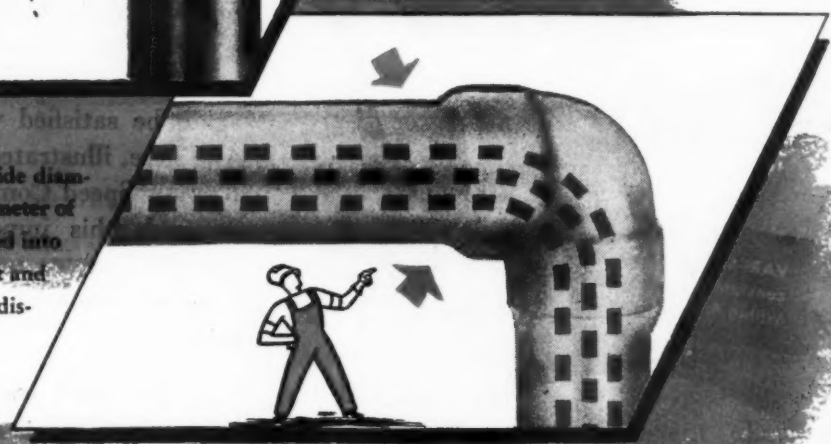
FAST



● Slip a compact, light-weight Watson-Stillman Socket Welding Fitting over end of pipe. Long bands, extending well beyond bottom of socket provide ample reinforcement, eliminating weak sections. Accurate measuring and cutting of pipe unnecessary.



● Make a clean outside pipe fillet weld. Deep socket, supports and aligns the pipe, eliminating tack welding, and the use of special fixtures. Position of weld prevents welding icicles inside pipe — no clogged lines. Wall sections, 1¼ times the nominal pipe thickness permits proper heat penetration and correctly proportioned fillet weld.



● Smooth flow assured as inside diameter of fitting matches inside diameter of pipe. The fitting and pipe are fused into one integral unit, permanently tight and leak-proof. Unaffected by vibration, distortion and shock.

Watson-Stillman Socket Welding Fittings are available for use with Standard Pipe—Schedule 40; Extra Heavy Pipe—Schedule 80; Schedule 160 Pipe and Double Extra Heavy Pipe—Sizes ¼" through 4" I. P. S.

Sold Through Leading Distributors

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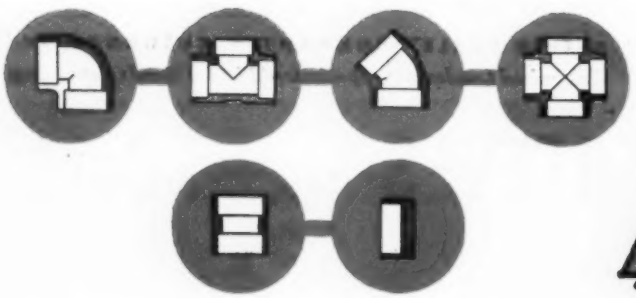

WATSON-STILLMAN

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Now—an even better GULF PARVIS OIL!

- even greater resistance to oxidation
- even better performance
- nonfoaming

This improved oil can help you make further cuts in Diesel maintenance costs—

FOR OVER 15 YEARS Gulf Parvis Oil has been a leader in the lubrication of industrial and marine Diesels. Now modern petroleum technology makes possible a further improvement in this quality oil—giving it greater resistance to oxidation and longer life. And the new Gulf Parvis Oil is nonfoaming under any service condition!

In your Diesels, this improved oil means better protection against wear, longer Diesel life, and lower maintenance costs. More than ever, Gulf Parvis Oil is the ideal lubricant for industrial and marine Diesel engines!

For further information regarding this new improved Diesel lubricating oil, mail the coupon or get in touch with your nearest Gulf office.

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Please send me, without obligation, complete information on the new improved Gulf Parvis Oil.

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Time to rewire the Hot Spots

Now that you can *select* whatever you want in wire and cable it's time to take a trouble-shooting trip around your plant . . . check up on war-weakened power, lighting and control circuits that run around boilers, furnaces, steam lines, soaking pits, kilns, lehrs or other hot spots . . . and don't forget the motor leads that have taken more than their share of over-load-heat, oil or grease. Then plan to replace all emergency war-time wiring that won't take years of abuse in locations where *trouble* starts—with *permanently insulated* Rockbestos A.V.C.

Every wire, cable and cord in the Rockbestos line was designed to stand up in an installation where other wires failed. They are all highly resistant to heat, moisture, oil, grease, corrosive fumes and flame. And they eliminate wire-failures and prevent service interruptions.

ROCKBESTOS A.V.C. 600 V. MOTOR LEAD CABLE
(Nat. Elec. Code, Type AVA—max. operating temp. 110°C.)
Flexible conductor insulated with two impregnated felted asbestos walls and a high dielectric varnished cambric insert and covered with an asbestos braid. Resistant to heat, flame, moisture, oil and grease. Sizes No. 18 AWG to 1,000,000 CM.

ROCKBESTOS A.V.C. 600 VOLT POWER CABLE
(National Electrical Code, Type AVA—max. operating temp. 110°C.)
Insulated with two impregnated felted asbestos walls and a high dielectric varnished cambric insert and covered with a rugged asbestos braid—withstands heat and condensation in steam tunnels, boiler rooms, etc. In sizes No. 18 AWG to 2,000,000 CM.

ROCKBESTOS A.V.C. 600 V. BOILER ROOM WIRE
(Nat. Elec. Code Type AVA—max. operating temp. 110°C.)
Insulated with high dielectric varnished cambric, impregnated felted asbestos and covered with an asbestos braid. Heat, flame and moisture resistant for permanent control and lighting circuits in hot locations. In sizes No. 18 to 4/0 AWG.

Send for samples of these *permanently insulated* Rockbestos wires and a catalog describing many of our 125 standard constructions and Rockbestos-designed National Electrical Code types. Write to your nearest district office or:

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WITH PERMANENT INSULATION

FOR VICTORY . . . BUY MORE WAR BONDS

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Licenses may be obtained from:

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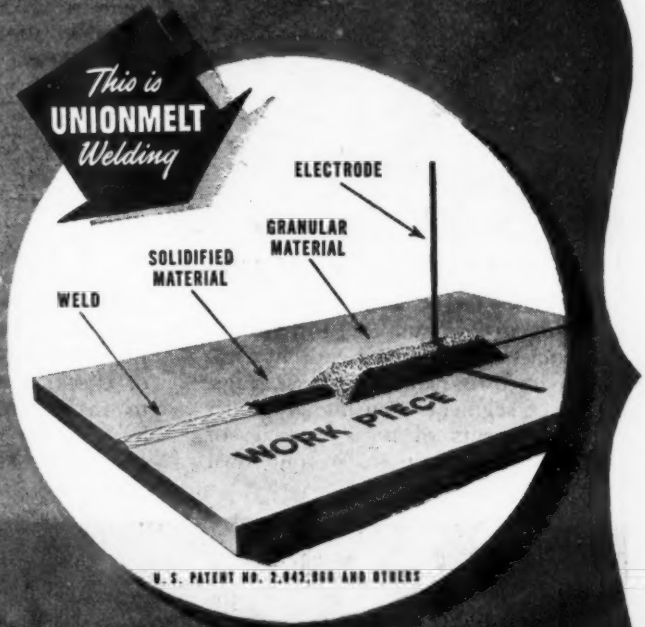
- Manufacturers of Pipe and Tubes
- Structural Steel Fabricators
- Machinery Manufacturers
- Household Equipment Manufacturers



A process of welding electrically beneath a mineral melt

. . . and successful producers of other things as widely varied as airplane propellers, tanks, gun mounts, blowers, chemical plant equipment, conveyor screws, and sheet metal parts.

UNIONMELT welding is electric welding done as diagrammed above. It makes top quality welds at speeds that are greater than with any other similarly applicable process.

Anyone who wishes to use this patented invention may do so under our standard license agreement. License fees are low and based upon extent of use. Complete engineering assistance is available to licensees.

For additional information send for "Report No. 6 on the Use of Linde Methods in Mass Production" or ask a Linde representative to help you determine where you can use the UNIONMELT process advantageously.

MARITIME "M" AWARD FOR OUTSTANDING PRODUCTION ACHIEVEMENT

THE LINDE AIR PRODUCTS COMPANY

Unit of Union Carbide and Carbon Corporation

30 E. 42nd St., New York 17, N. Y. UCC Offices in Other Principal Cities

In Canada: Dominion Oxygen Company, Limited, Toronto

The word "Unionmelt" is a registered trade-mark of The Linde Air Products Company

★ BUY UNITED STATES WAR BONDS AND STAMPS ★

Soup's On for a hundred Gauge Sockets

ONE OF THE REASONS 6 OUT OF 10 PICK U. S. GAUGES

WE REAR GAUGES FROM THE LADLE

It is no secret that U. S. is the only gaugemaker building instruments from parts fashioned entirely within its own plants. Sockets, rings, cases, segments, housings and other components of brass, bronze, or iron are cast right in our own foundries. These foundries have a notable reputation for quality in quantity.

IN GAUGES, IT'S U. S. OVER 6 TO 4—

For every ten times gauges are selected by original equipment manufacturers, the choice is U. S. in over six. The fact that all operations, casting being one of them, are completed within our own shops contributes to this overwhelming preference. But the real reason is *Manufacturing Control*, a program of checking and double checking to make sure each U. S. gauge leaving the plant is a worthy ambassador of our Company.

US Gauges

← KEEP YOUR EYE PEELED FOR THIS GREAT GAUGE CATALOG

Now being rushed to completion. Available soon. Over 100 pages jam-packed with information on gauges, gauge movements and gaugemaking. Gauges double-referenced for ease in selection. Special guide for ease in ordering. Reserve your copy today (no obligation) . . . on your business letterhead, please.

SALT FOR THE SOUP—What sand to use, how tight to ram, how fast to pour are the ingredients with which our men, with up to 25 years' experience, season the broth . . .

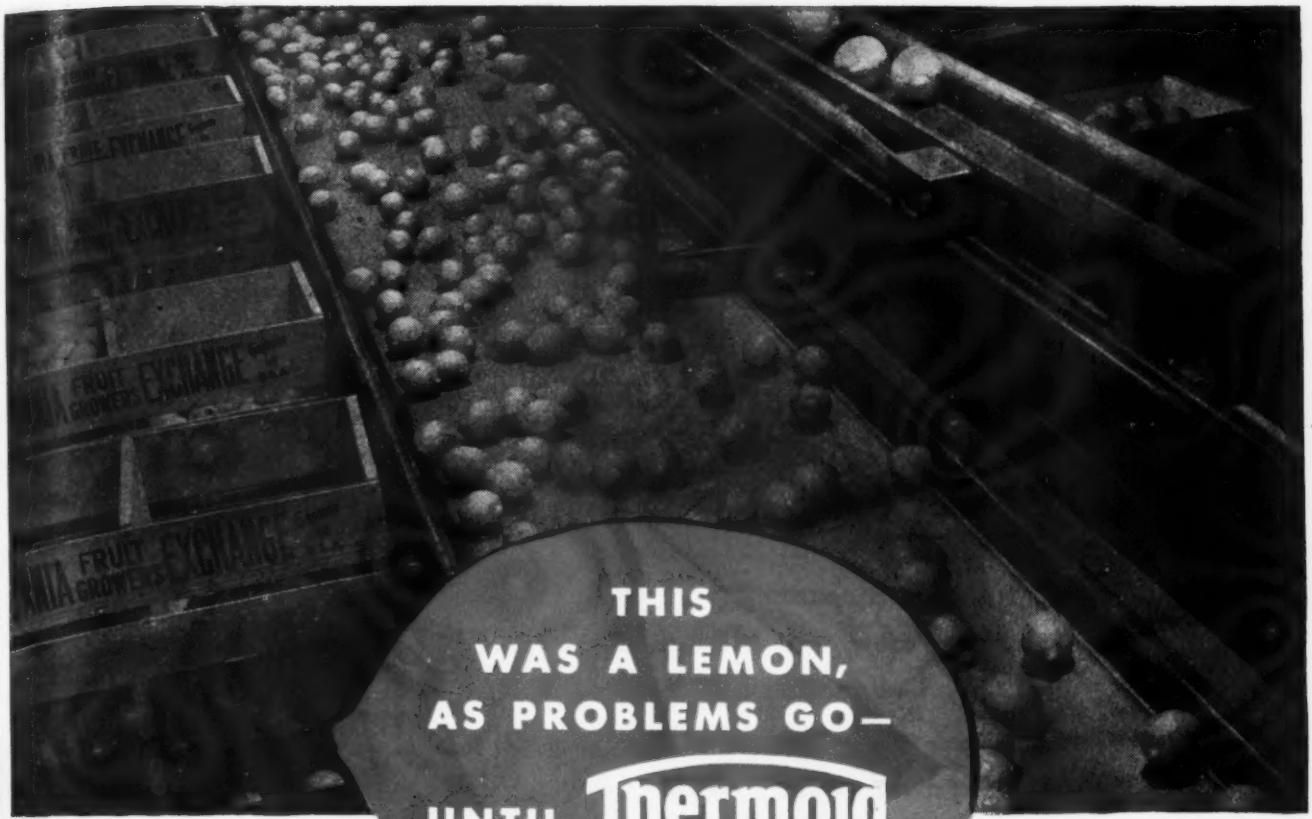
UNITED STATES GAUGE CO.

SELLERSVILLE, PA.

Manufacturers of Pressure, Temperature, Flow, Electrical and Level Measuring Instruments

U.S. INSTRUMENTS Tell The Truth

USG



THIS WAS A LEMON, AS PROBLEMS GO— UNTIL Thermoid SOLVED IT!

While studying the citrus fruit packing industry, Dr. McClelland discovered that lemon sorters and graders were suffering unusual eye fatigue, which could be corrected by using grading belts of a special color. Dr. McClelland then specified a color which would give sufficient contrast to the color of the fruit for efficient sorting and yet provide a softer background, restful to the eyes of the graders.

Thermoid worked with Dr. McClelland. We found there were three things to be considered in making this new conveyor belting: (1) Making belts match the colors specified; (2) Making the belt's surface impervious to fruit mold—also a surface which would be easily sterilized; (3) Making a belt with a surface that would not rub off or discolor the fruit.

Thermoid is the only company licensed to manufacture Dr. McClelland's "Easy on the Eyes" Conveyor Belting. When war time restrictions are lifted, Thermoid will manufacture more of this belting.

This example of problem-solving ability was taken from our files to demonstrate that Thermoid engineering, research and manufacturing facilities—and the services of Thermoid's field representatives—are at your disposal in the solution of *your* industrial rubber problems.

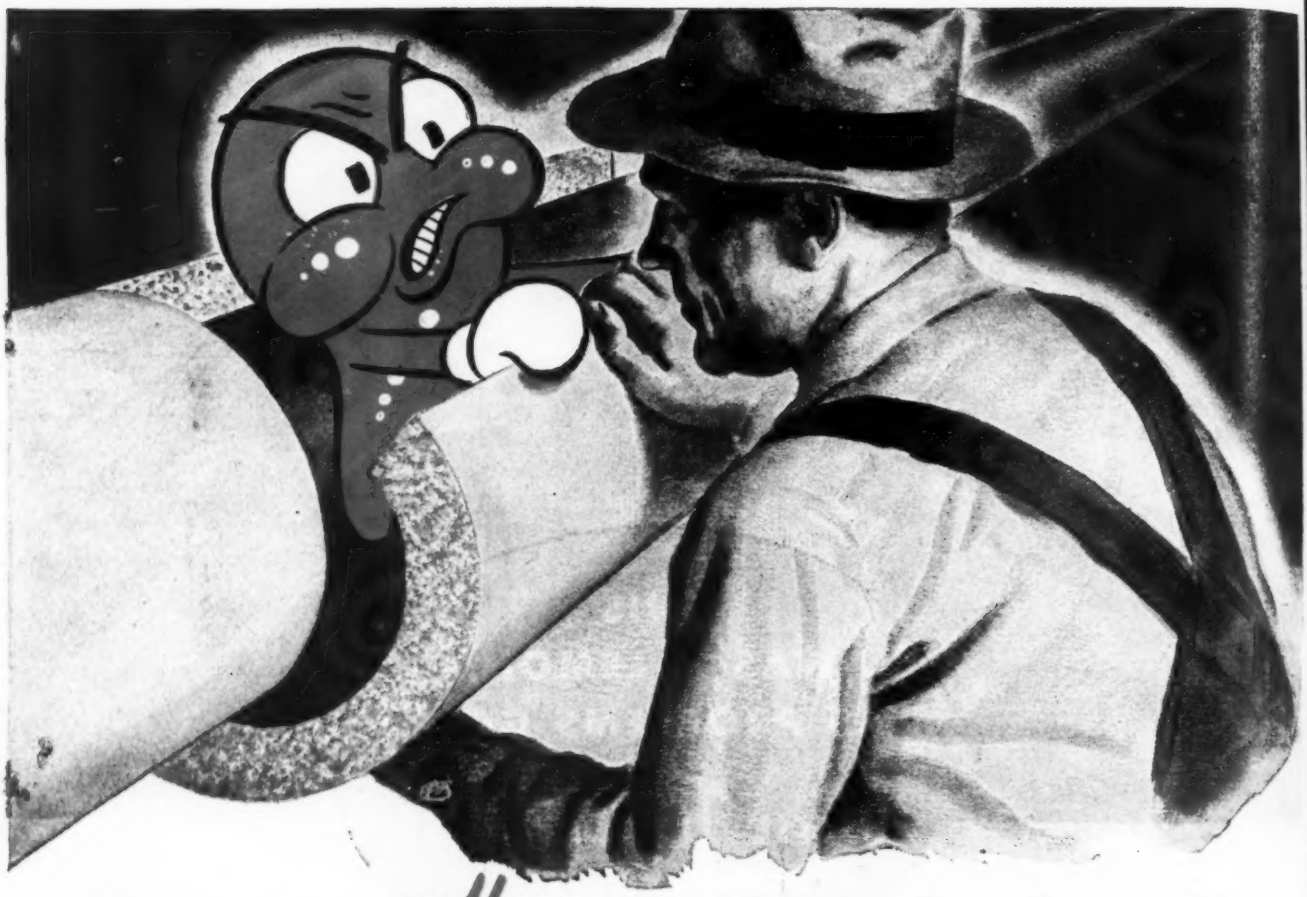
DON'T PUT IT OFF 'TIL TOMORROW *Buy More War Bonds Today!*

Thermoid Rubber

DIVISION OF THERMOID COMPANY
TRENTON, NEW JERSEY

"IT'S GOOD BUSINESS TO DO BUSINESS WITH THERMOID"

THE THERMOID LINE INCLUDES: TRANSMISSION BELTING • F.H.P. AND MULTIPLE V-BELTS AND DRIVES • CONVEYOR BELTING • ELEVATOR BELTING • WRAPPED AND MOLDED HOSE • SHEET PACKINGS • INDUSTRIAL BRAKE LININGS AND FRICTION PRODUCTS • MOLDED HARD RUBBER AND PLASTIC PRODUCTS



How to *collar* Mr. BTU—for keeps!

NATIONWIDE DISTRIBUTION—

Warehouse stocks of the broad Carey line provide service regardless of job location.

CAREY INSULATION ENGINEERING SERVICE **makes available the knowledge and experience of leading authorities.**

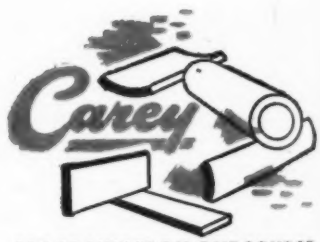
Every uninsulated or inadequately insulated pipe, boiler, oven, turbine or furnace is an invitation for BTU's to go AWOL . . . and waste costly energy.

The way to keep BTU's on the job—and working, is by making sure your equipment is properly insulated . . . adequately insulated.

Carey takes the guesswork out of heat insulation by offering you (1) a *complete* line of types, sizes and shapes plus (2) the engineering ability to determine the one best or combination of insulations for your needs.

To benefit by Carey's 70-odd years of heat insulation experience just write—

TRAINED ERECTION AND SERVICE CREWS **"make sure" the job is done right.**



BROAD LINE FROM ONE SOURCE.

No need to compromise with desired results. You get the right insulation for the job.

THE PHILIP CAREY MANUFACTURING CO.

LOCKLAND, CINCINNATI 15, OHIO

IN CANADA: THE PHILIP CAREY CO., LTD. OFFICE AND FACTORY: LENNOXVILLE, P. Q.

Careyduct • Industrial Insulations • Rock Wool Insulation • Asbestos Shingles and Siding • Asphalt Shingles and Roofings
Built-up Roofing • Roof Coatings and Cements • Waterproofing Materials • Asphalt Tile Flooring • Pipeline Felt
Expansion Joint • Asbestos Wallboard and Sheathing • Corrugated Asbestos Roofing and Siding • Miami-Carey Bathroom Cabinets and Accessories

WE TAKE PRIDE IN ANNOUNCING A

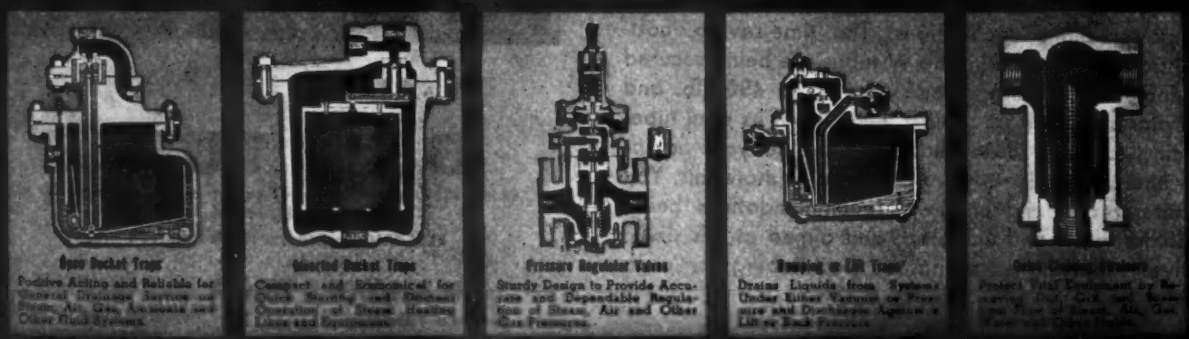
"Blessed Event"

For thirty-seven years we have manufactured fluid controls of high quality that were marketed under an old nationally known name.

We have now assumed the distribution of our own products, which will henceforth be sold under the name "CLARK FLUID CONTROLS."

The Clark Manufacturing Company's long years of experience in the engineering, developing and manufacturing of steam specialties is now directly available to you.

Clark



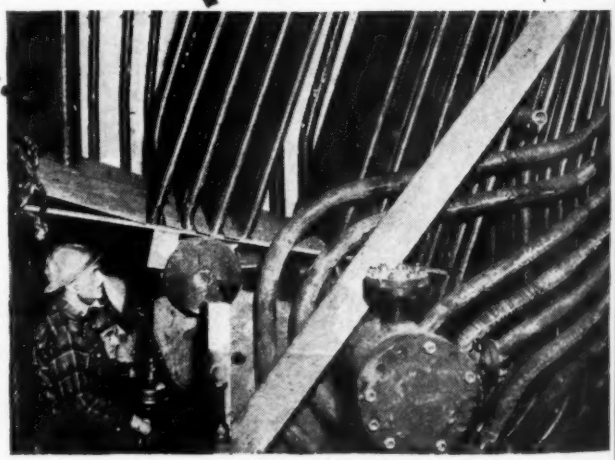
THE CLARK MANUFACTURING CO.

1830 EAST 38TH STREET • CLEVELAND 14, OHIO

dual service...with a single purpose

Piercing Seamless Tubing in one of the B&W specialty tube mills.

B&W Welded Tubing is made by the Electric-Resistance welding process.



Finding the right kind of tubing for any steam generating and heat transfer equipment is greatly simplified when the problem is put up to Babcock & Wilcox. Matching tubes to jobs—applying the kind that will stand up best in any combination of operating conditions—is a specialty at B&W.

Here your requirements are considered in the light of over 40 years' experience gained from making more than 700 million lineal feet of pressure tubing—both seamless and welded—for all types of stationary, locomotive and marine boilers as well as for heat exchangers, condensers and other power plant applications. The time-saving, cost-cutting advantages of using B&W tubes are being secured in equipment operating at pressures up to 4500 lb. and temperatures as high as 1500 F. Because of its dual tube-producing facilities, B&W matches tubes to your equipment without prejudice toward any type or materials. You can therefore depend on B&W recommendations being both authoritative and unbiased, and aimed at this single objective: supplying you with the best tubing for each specified job.

B&W TUBES

SEAMLESS. Complete range of carbon alloys and stainless steels
Sizes: ½ in. to 8⅝ in. O.D.

ELECTRIC-Resistance Welded Carbon grades
Sizes: ¾ in. to 4 in. O.D.

THE BABCOCK & WILCOX TUBE COMPANY

Seamless Tube Division
BEAVER FALLS, PA.

Welded Tube Division
ALLIANCE, OHIO

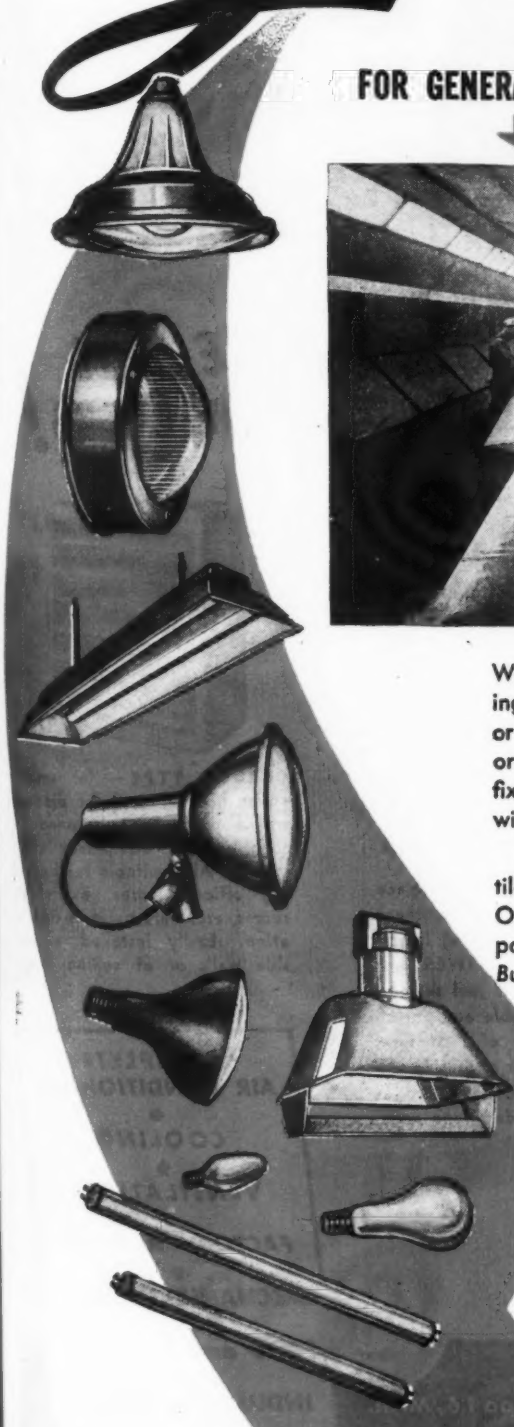
B&W MAKES BOTH

TA-1310A

Light

FOR LOCAL AREAS

FOR GENERAL ILLUMINATION



Whether your lighting problem is one of raising illumination level, of avoiding glare or ending shadows — a Graybar Lighting Specialist can help you or your electrical contractor solve it. For general illumination, or for local or supplemental lighting, Graybar can supply suitable indoor or outdoor fixtures (incandescent, fluorescent, or mercury), matching G-E Mazda lamps, wiring, transformers, and ballasts.

Graybar also distributes motors, cable, communication systems, ventilating apparatus, welding equipment, and many other electrical needs. Our nationwide network of warehouses offers you the fastest deliveries possible under today's conditions. *Graybar Electric Company, Graybar Building, New York 17, N. Y.* 4558

IN OVER 80 PRINCIPAL CITIES

Via GraybaR

...the Double-Duty Source of Supply

Put your Factory Heating on a Postwar Competitive Basis

STOP WASTE with CLARAGE UNIT HEATERS!

LOWER OPERATING COSTS!—that's what most companies must have to meet tough postwar competition.

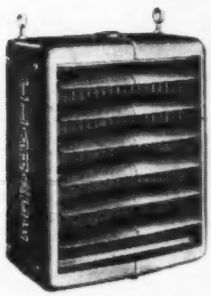
What did it cost to heat your plant last winter? How was it heated? Possibly there's an opportunity to save a nice fat sum right here on this one item: *factory heating!*

There *certainly is*, if you're still using wasteful coils or cast iron radiation, or if you've been getting along with obsolete or worn out unit heaters which lack the high efficiency and fuel-saving features of Clarage Units.

Another winter coming up! Clarage Unit Heaters installed now can start paying for themselves immediately—not only by stopping fuel wastage, but by helping your plant maintain top-level production so dependent upon uniform, comfortable temperatures.

Clarage Unit Heaters are built in sizes to meet all types of jobs, operating on steam or hot water—prompt deliveries where necessary. Call in our application engineers for a consultation—write, wire or phone us today.

UNITHERM TYPE—for large space, wide area applications. Syncrotherm Control (a patented feature) insures adequate heating with LOWER temperature air—important fuel savings! Square outlets removable and adjustable for 4 directions of heat flow. V-belt drive for quieter operation. All parts easily accessible. Furnished as either floor or suspended type units.



CLARCO TYPE—for small space heating, and for places where more heat is needed than present equipment can supply. Also suitable for heating offices, stores, assembly rooms, etc. Very quiet in operation. Easily installed along side walls or at ceiling line.

ARMY E NAVY

COMPLETE AIR CONDITIONING
•
COOLING
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VENTILATION
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FACTORY HEATING
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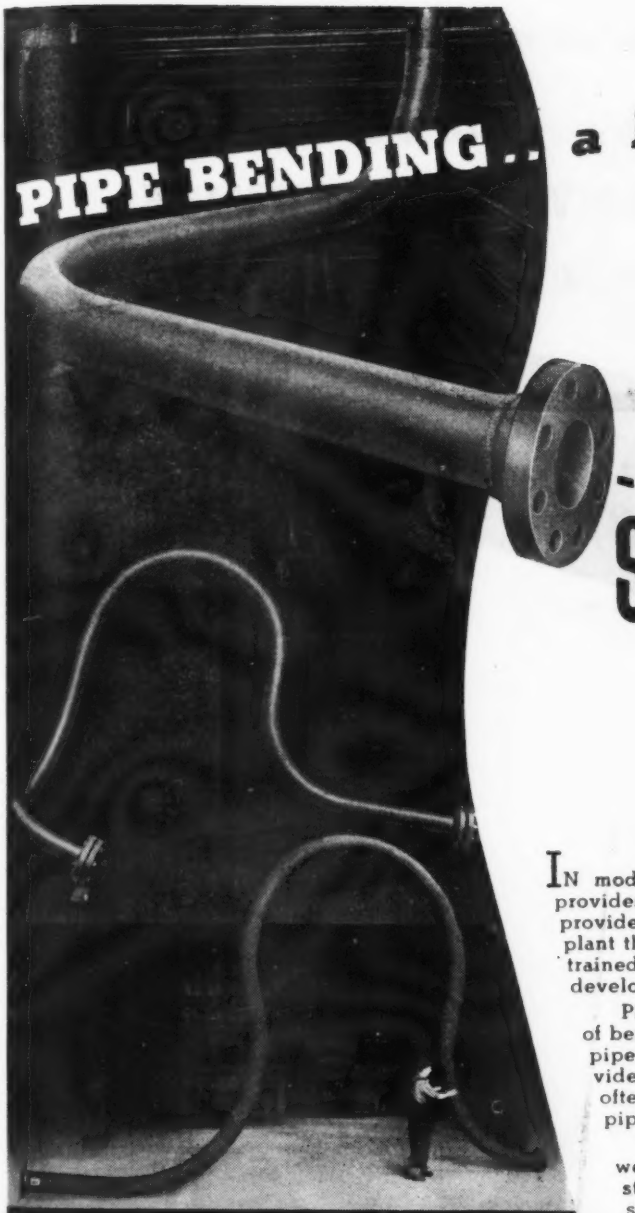
MECHANICAL DRAFT
•
FANS and BLOWERS for INDUSTRIAL NEEDS

Clarage Fan Company Kalamazoo 16, Mich.

APPLICATION ENGINEERING OFFICES IN ALL PRINCIPAL CITIES



PIPE BENDING .. a highly developed art . . .

an important part of

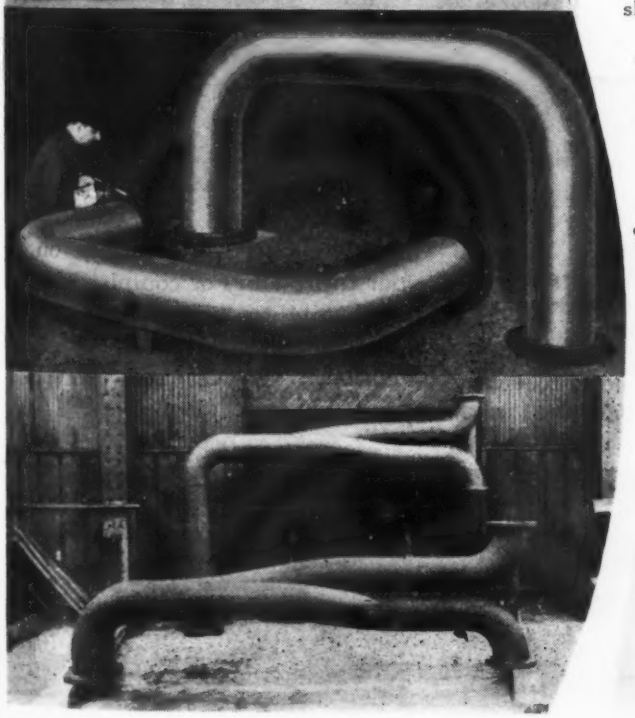
MODERN SHOP FABRICATION

IN modern streamlined piping systems the utilization of pipe bends provides many advantages not obtainable through the use of fittings . . . provided the bends are properly designed and shop-fabricated in a plant that has the necessary facilities and equipment, and a crew of trained experts who know how to use that equipment, in this highly developed art of piping fabrication.

Pipe bends may be made for any desired overall length; a number of bends may be made in a single length of pipe, so as to produce a pipe connection, tailor-made for available space; flexibility is provided in systems subject to thermal expansion; long-radius bends often save material and reduce pressure drop caused by internal pipe friction.

Expert shop fabrication provides proper distribution of field welds and confines them to areas not subject to high bending stress; it reduces the number of welds and saves time, in both shop and field.

When planning and designing piping systems for additions, alterations or new installations, consider the advantages of incorporating pre-fabricated pipe bends in place of fittings. They are tailored to fit installation conditions, without interference with other piping or auxiliary equipment. The result is a neater, more compact and efficient system, and field installation time is reduced to a minimum.



ARMY E NAVY

Pittsburgh Piping

AND EQUIPMENT COMPANY

10 Forty-Third Street—Pittsburgh, Penna.

Woolworth Building, New York
Chamber of Commerce Bldg., Indianapolis
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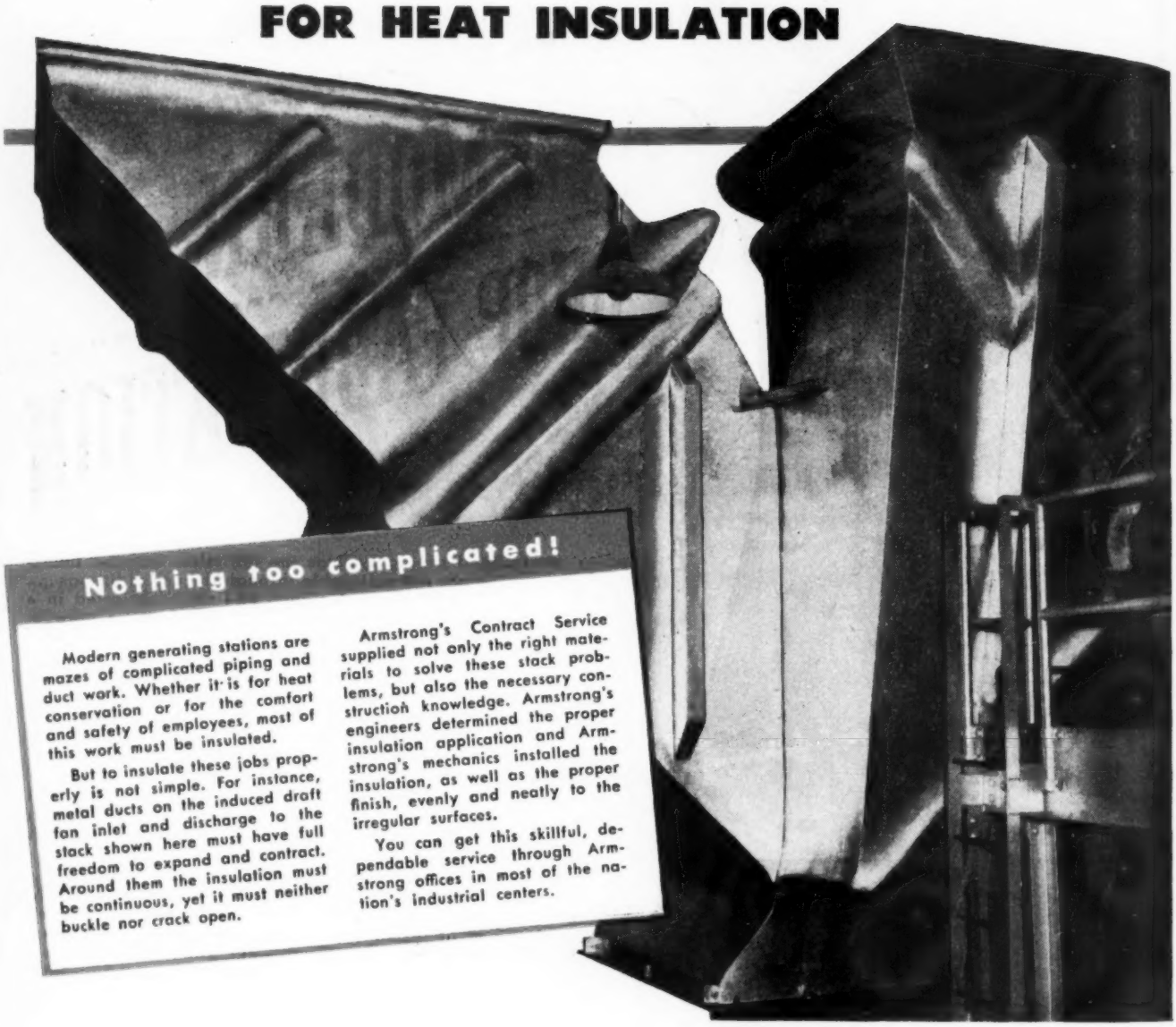
634 S. Gramercy Place, Los Angeles

BUY MORE WAR BONDS

Your toughest installation problems are solved by ARMSTRONG'S CONTRACT SERVICE FOR HEAT INSULATION



Nothing too complicated!

Modern generating stations are mazes of complicated piping and duct work. Whether it is for heat conservation or for the comfort and safety of employees, most of this work must be insulated.

But to insulate these jobs properly is not simple. For instance, metal ducts on the induced draft fan inlet and discharge to the stack shown here must have full freedom to expand and contract. Around them the insulation must be continuous, yet it must neither buckle nor crack open.

Armstrong's Contract Service supplied not only the right materials to solve these stack problems, but also the necessary construction knowledge. Armstrong's engineers determined the proper insulation application and Armstrong's mechanics installed the insulation, as well as the proper finish, evenly and neatly to the irregular surfaces.

You can get this skillful, dependable service through Armstrong offices in most of the nation's industrial centers.

CORRECT ANSWERS to the complex engineering questions that can arise on any heat insulation job are yours when you use Armstrong's Contract Service. You get the benefit of Armstrong's wide engineering experience. You also get materials of tested efficiency and trained skillful workmanship in application. Furthermore, this large, dependable organization takes full responsibility for every part of the planning, supervision, materials, and workmanship on your entire job. For complete details, write to Armstrong Cork Co., Building Materials Division, 7008 Concord Street, Lancaster, Penna.

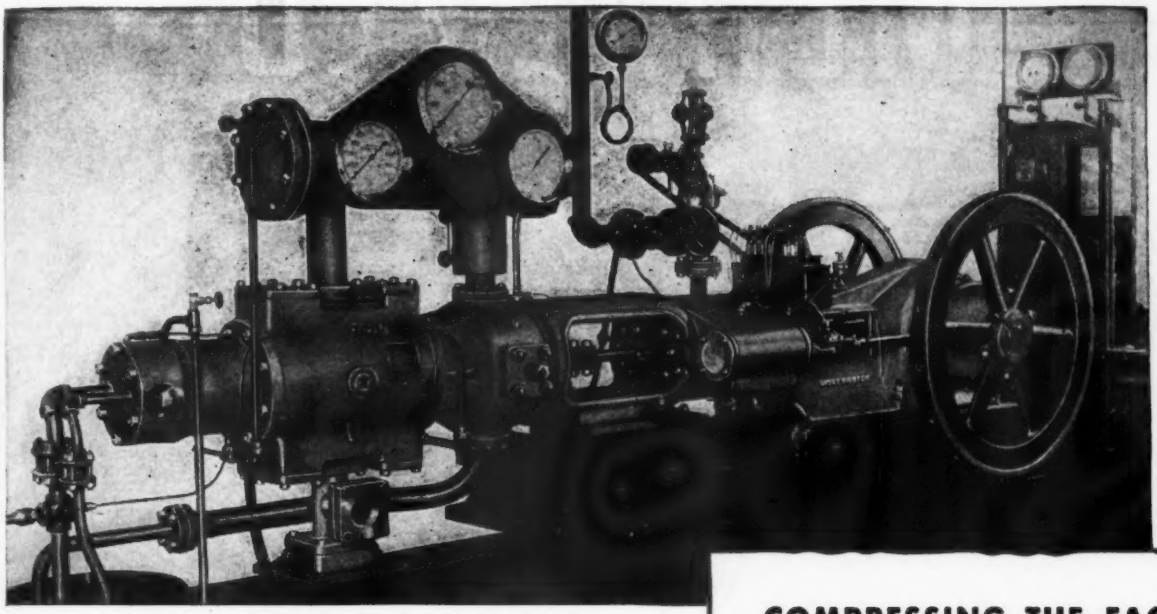
ARMSTRONG'S INDUSTRIAL INSULATION

Complete Contract Service For All Temperatures

From 300° Below Zero

To 2600° Fahrenheit

HIGHER PRESSURES AT LOWER COST



A Worthington Type HB3 single tandem three-stage compressor as installed in an important chemical plant.

With 2 Exclusive Worthington Compressor Advantages

No other three-stage high-pressure compressor can offer you these advantages:

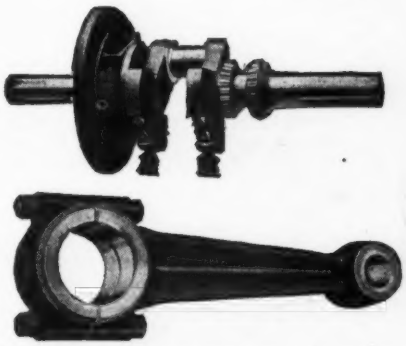
1. *Only one stuffing box*, and that subjected only to moderate pressures, minimizes leakage, so important when compressing costly or inflammable gases. Minimizes maintenance, too.

2. *Requires 20% less floor space*. Compact, without any distance pieces, the HB3 costs less in floor space and foundations than any other compressor of its kind.

Write: Worthington's Publications Department, Harrison, N. J. for Bulletin L-611-B12B, describing Worthington's exclusive Feather* Valves . . . automotive-type bearings and rods . . . steam and motor-driven HS and HB 3-stage models. *Worthington Pump and Machinery Corporation, Buffalo Compressor Division, Buffalo, N.Y.*

*Reg. U.S. Pat Off.

COMPRESSING THE FACTS



Worthington was first to use time-saving automotive-type bearings and rods on compressors, instead of old-fashioned wedge-adjustable design. *In 8 years of use, replacement of bushings has averaged only 1/10 of 1% in all HB machines installed!*

WORTHINGTON *BEHIND THE NAME* WORTHINGTON

NO OTHER COMPRESSOR WILL OUTPERFORM A WORTHINGTON

B14-81

MODERN DEVELOPMENTS OF GASKET RESEARCH

METALLIZED...

Popular Gasket Beats Sheet Packing for Many Uses

Good news for the thousands of users who have always preferred this type of gasket.

The Metallized Goetze No. 2 Corrugated Metal-Asbestos Gasket is *NOW AVAILABLE AGAIN.* This Gasket has a bright metallic coating which increases resistance to heat, pressure, moisture and corrosion — providing much longer life. The metallic coating also prevents the gasket from sticking to flanges. Because it may be reused, this gasket actually costs no more than sheet packing in the long run, and saves many headaches in handling.

Made of deeply corrugated metal with twisted and treated asbestos cord cemented into the corrugations on both faces, this gasket offers extreme resilience to compensate for uneven alignment or rough flange surfaces.

Ask to have your name added to the list of engineers receiving "The Gasket" — a series of technical bulletins containing original gasket data emanating from the Goetze Research Laboratory. Write on your company letterhead giving your position.

GOETZE GASKET & PACKING CO., INC.
10 ALLEN AVENUE, NEW BRUNSWICK, NEW JERSEY

Boston *New York* *Philadelphia* *Pittsburgh*
Cincinnati *Cleveland* *Detroit* *Chicago*
Houston *San Francisco* *Los Angeles* *Montreal*

Goetze for GASKETS

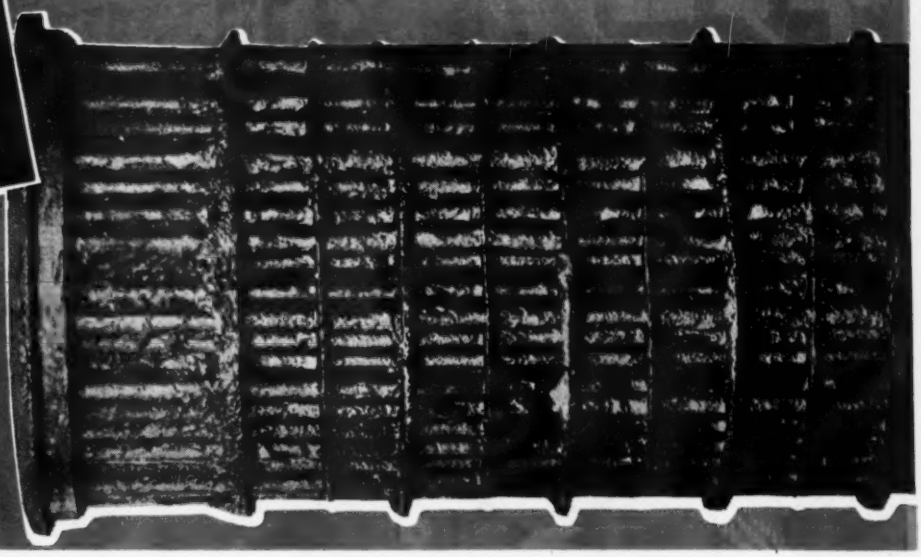
"America's Oldest and Largest Industrial Gasket Manufacturer"

PAGE 2

OAKITE

"PRESCRIPTION NOTE BOOK"

ONE OF A SERIES of data sheets for power plant engineers outlining various Oakite maintenance and equipment cleaning tasks. Each sheet may be filed for reference to serve as a reminder for obtaining more specific information.



Operating Efficiency of HEAT EXCHANGE Equipment Stepped-Up by Oakite Cleaning

Other Power Plant Cleaning Jobs for OAKITE

Automatic Filters . . . Electrical Precipitators . . . Controlling Slime and Scale Formation in Air Wash Air Conditioning Units . . . Cleaning Evaporative Condenser Coils . . . Controlling Slime and Mold in Humidifying Systems . . . Cleaning and Descaling Diesel or Gasoline Engines . . . Cleaning and Descaling Jacket Water Coolers and Lube Oil Coolers . . . Cleaning Surface Condensers . . . Cleaning Water and Steam Condensate Meters . . . Descaling Water Cooled Compressors . . . Cleaning Unit Heaters . . . Descaling Ammonia Condensers . . . Cleaning Transformers . . . Cleaning Painted Surfaces of Equipment . . . Stripping Paint . . . Cleaning Floors.

NOTE: The Oakite Technical Representative in your locality is ready to give you the benefit of his experience and personal help on any power plant cleaning or related problem. This Advisory Service is free.

Because most heat exchange equipment, in time, acquires deposits that insulate surfaces and impair heat transfer in increasing degree as they continue to build up, regular cleaning of these units is a necessary maintenance procedure both from the standpoint of economy and of stepping up efficiency and capacity.

Oakite Materials and Methods Help You Handle Equipment Maintenance Easily . . . Economically

Removal of carbonized oil, sludge, wax, lime scale, rust and corrosion products, slime and other deposits from oil coolers and heaters, jacket-water coolers, feedwater heaters, evaporators and other heat exchange equipment is effectively, safely and easily accomplished with either Oakite alkaline, solvent or inhibited acidic materials specially designed for this work. Whether circulating, tank or steam-cleaning methods are used, normal heat transfer efficiency is restored in comparatively short time. The new third edition of the Oakite Maintenance Digest for power plant engineers, gives you further data, and is free for the asking. Write for your copy today!

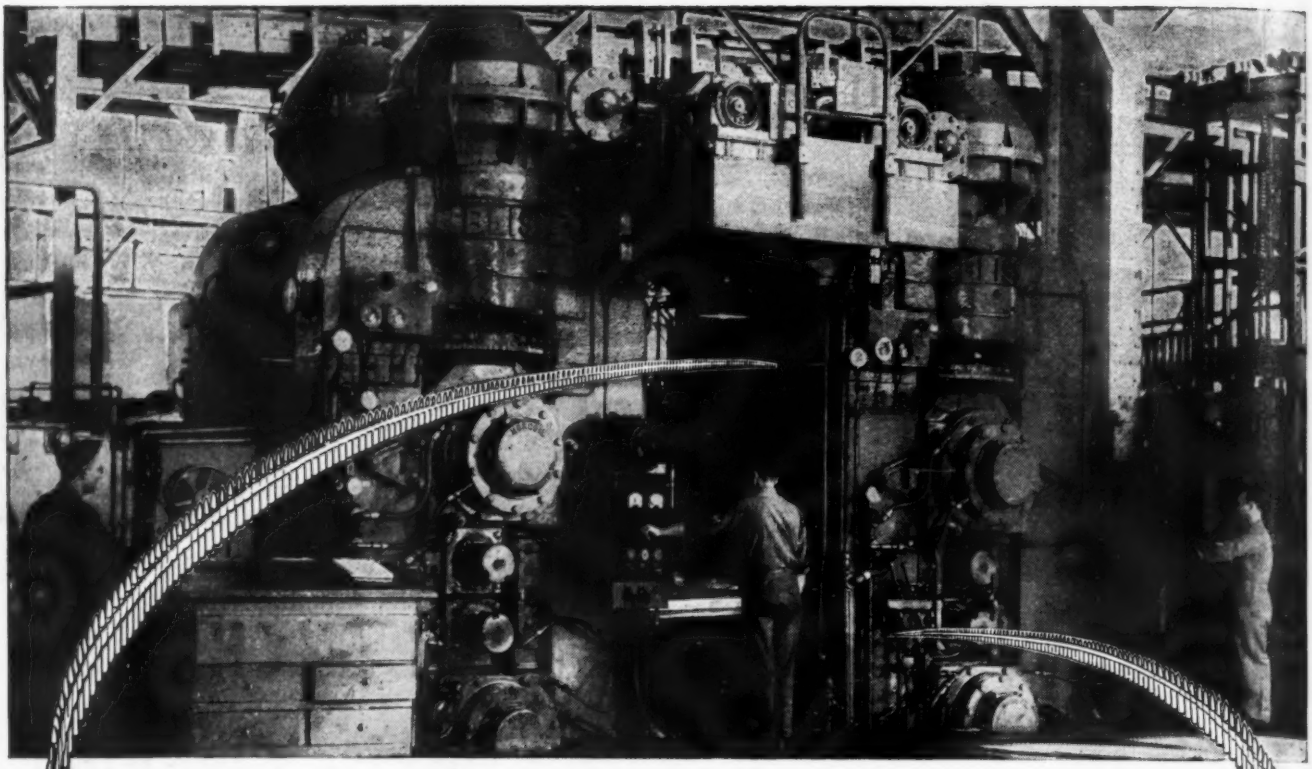
OAKITE PRODUCTS, INC. 23 Thames Street New York 6, N. Y.

Technical Service Representatives Located in All Principal Cities of the United States and Canada

OAKITE

Specialized cleaning

MATERIALS & METHODS FOR EVERY CLEANING REQUIREMENT



HOW BOWSER HELPS **WESTERN BRASS MILLS** PRODUCE

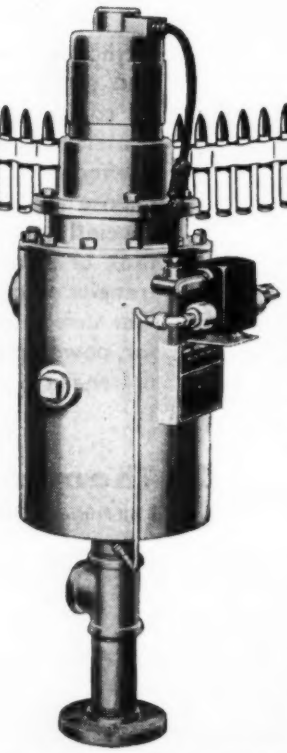
Bullets by the Billion

More than a billion pounds of brass—every pound of which has been used in the production of an endless stream of cartridges for the United Nations—is the remarkable contribution to the war effort made by Western Brass Mills, division of Olin Industries, Inc.

This staggering figure represents a tonnage equivalent to a fleet of eleven modern battleships or aircraft carriers of 45,000 tons each!

A Bowser Lubrication-Filtration system has helped to keep this giant 4-high tandem brass mill running at full speed. Oil that is continuously filtered is pressure-circulated to every moving part, thus preventing bearing failure which would mean a costly shut down and the loss of millions of urgently needed cartridges.

In the Power industry other types of Bowser equipment are giving equal performance—turbine oil conditioners, filters and force feed lubricators, for instance.



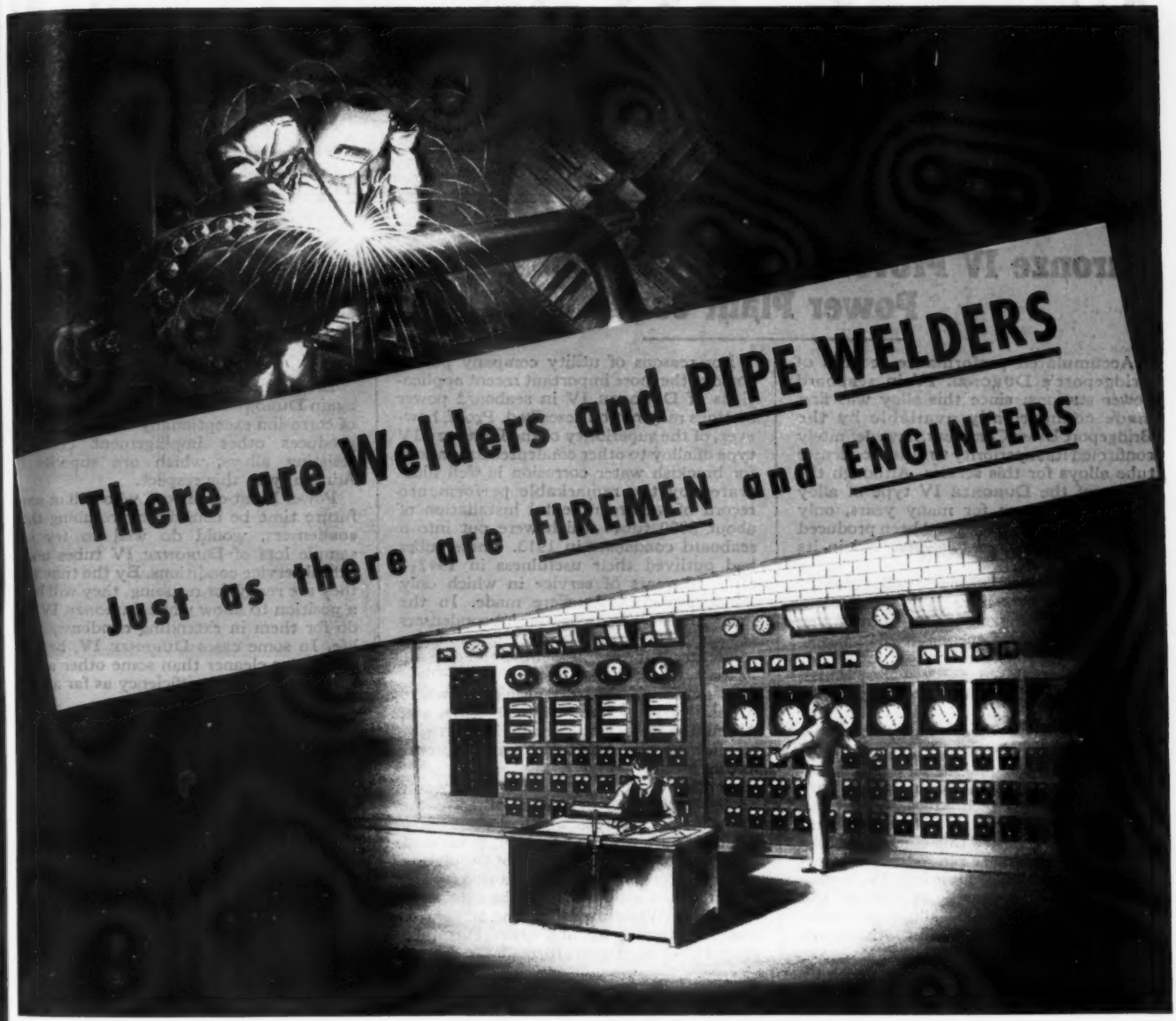
Impartial experts have definitely proved that oil, if kept perfectly clean, remains as good as new. Bowser Pressure Filters, in plant after plant, are daily demonstrating their ability to keep oil clean and efficient much longer—thus saving money and prolonging the life of the equipment. For details write BOWSER, INC., Dept. 2-H, Fort Wayne 2, Indiana.

Not only has Bowser's war production earned the Army-Navy E... Bowser equipment has helped earn it for scores of other companies.

BOWSER

SINCE 1885

THE NAME THAT MEANS **EXACT CONTROL** OF LIQUIDS



. A fireman or water tender serves a useful purpose . . . we couldn't get along without him. But he isn't an engineer. The engineer must have training and experience which the other man has not yet acquired. Many men are satisfactory firemen or water tenders who do not have the special aptitude to become good engineers.

Ordinary welders may be capable enough for ordinary work . . . but they aren't pressure piping welders. Operators capable of welding pressure piping must have special aptitude, careful training and plenty of experience. They must be painstakingly qualified in different positions and tested on procedures for various classes of materials.

Welders of these abilities are not easy to find . . . particularly in times of heavy demand for skilled labor. Pipe fabricators employ large numbers of qualified pressure piping welders. These welders work under the most favorable conditions and are closely supervised to make certain they exactly adhere to predetermined welding procedures that have proved correct for the particular job. Their work meets the most exacting standards . . . piping so fabricated is insurable.

Purchase of pre-fabricated piping from qualified fabricators is the best and most economical way to obtain quality pressure piping.

P.F.I.
THE PIPE FABRICATION INSTITUTE

THE PIPE FABRICATION INSTITUTE

Devoted to the Technical and Economic Problems in Piping

1108 CLARK BUILDING • PITTSBURGH, PA.

P-10

COPPER ALLOY BULLETIN

MARINE AND POWER EDITION

REPORTING NEWS AND TECHNICAL DEVELOPMENTS OF COPPER AND COPPER-BASE ALLOYS

Prepared by Bridgeport Brass Company — "Bridgeport" BRASS Co. — *Headquarters for BRASS, BRONZE, and COPPER*

Duronze IV Proven Ideal for Seaboard Power Plant Condenser Tubes

Accumulated performance records of Bridgeport's DURONZE IV in seaboard power stations, since this alloy was first made commercially available by the Bridgeport Brass Company, have definitely confirmed its superiority to other condenser tube alloys for this service. Although the merits of the DURONZE IV type of alloy have been known for many years, only experimental quantities had been produced because of the difficulties involved in its manufacture.

Condenser installations on polluted estuaries and harbors have long been recognized as presenting one of the most complex corrosion problems encountered in power plant practice. The mixing of tidal salt water with polluted fresh water, which may contain acid waste, sewage, and cinders introduces conditions that result in extremely severe corrosive attack on the commonly used alloys such as Admiralty, Aluminum Brass, and in some cases on Cupro Nickel. However, through the use of modern casting techniques and the use of more powerful mill equipment, Bridgeport was able to solve this corrosion problem for marine power plants by the commercial production of DURONZE IV. Today DURONZE IV is classed as one of the standard condenser tube alloys. Its composition is Copper 93.5% min., Aluminum 5% min., Arsenic 0.3% max.

For reasons of utility company policy, some of the more important recent applications of DURONZE IV in seaboard power stations may not be described. Proof, however, of the superiority of the DURONZE IV type of alloy to other condenser tube alloys for brackish water corrosion is well illustrated by the remarkable performance record of an experimental installation of about 5000 tubes which were put into a seaboard condenser in 1913. These tubes had outlived their usefulness in 1942—after 29 years of service in which only minor replacements were made. In the same power plant, two adjacent condensers of identical design had been using Admiralty condenser tubes whose life averaged six years.

In another seaboard power plant where Admiralty lasts from 2½ to 3 years, and Aluminum Brass 4 to 5 years, DURONZE IV has now been in over 6 years and is giving fine service.

Another serious problem in salt water power stations as well as in other plants using steam turbines which depend on a condenser that produces a high vacuum and calls for higher velocities of circulating water is "corrosion-erosion" caused by impingement of air bubbles on the condenser tube wall. When an impinging stream of water containing air and other entrained gases attacks and wears through the protective film of a plain brass condenser tube it gains access to the underlying layer of metal. The impinging stream then continues to aid in the removal of the metal since it cannot continue to produce a protective film in this particular spot. As a result, typical almond shaped undercut pits and holes are developed.

Bridgeport's answer to this problem is again DURONZE IV, which resists this type of corrosion exceptionally well. Bridgeport produces other impingement corrosion resisting alloys, which are superior to Admiralty in this respect.

Power Plant engineers, who will at some future time be considering retubing their condensers, would do well to try out sample lots of DURONZE IV tubes under actual service conditions. By the time that they are ready for retubing, they will be in a position to know what DURONZE IV can do for them in extending condenser tube life. In some cases DURONZE IV, because it remains cleaner than some other alloys, will permit greater efficiency as far as heat transfer is concerned.

All indications point to the fact that future demands for electric power will continue to grow because of greater use in the home, rural electrification, new industries, transportation, the increasing use of automatic industrial equipment powered by electricity, and many other factors. Operators must be prepared to keep their plants at top notch efficiency, with a minimum of shutdowns and maintenance problems.

Much data on DURONZE IV and other Bridgeport alloys and results of many years of corrosion research are published in Bridgeport's 112-page Condenser Tube Manual. Be sure to write for a copy using company stationery. Also, why not get acquainted with our nearest technical adviser who can help you increase condenser tube life.

Compositions and Specifications — Condenser and Heat Exchanger Tubes

Alloy	Composition % Copper	% Tin	% Aluminum	% Nickel	% Lead	% Iron	% Zinc	% Manganese	% Arsenic	Specifications A.S.T.M.
Admiralty Type "A"	70.0 min.	0.90-1.20			0.075 max.	0.06 max.	Remainder			*B111-43 Type "A"
Admiralty Type "B"	70.0 min.	0.90-1.20			0.075 max.	0.06	Remainder		0.10 max.	B111-43 Type "B"
Cuzinal (Alum. Brass) Type "B"	76.0 min.		1.75 min.		0.075 max.	0.06 max.	Remainder		0.10 max.	B111-43 Type "B"
Duronze IV	93.5 min.		5.0 min.						0.30 max.	B111-43
Muntz Metal	59.0-63.0				0.30 max.	0.07 max.	Remainder			B111-43
Red Brass	84.0 min.				0.75 max.	0.06 max.	Remainder			B111-43
*70-30 Cupro Nickel	Remainder	1.20 max.		29.0-32.0	0.06 max.	0.5 max.	1.0 max.	1.0 max.		*B111-43
80-20 Cupro Nickel	Remainder	1.0 max.		19.0-23.0	0.06 max.	0.5 max.	1.0 max.	1.0 max.		B111-43
Arsenical Copper	99.45 min.								0.15-0.50	B111-43
Copper	99.90 min.			Phosphorus 0.035 max.						B111-43

*Also meets Federal Spec. WW-T-656 and Navy Spec. 44T7f.

*Specifications for 70-30 Cupro Nickel are under revision and will probably show minimum and maximum values for manganese and iron that will not agree with the maximums now shown. Also meets Navy Spec. 44T-39.

Bridgeport Copper Tubing

The marine field is most appreciative of the advantages of copper tubing for pipe lines of all kinds because it combines lightness with strength and maintains tight connections under vibration which would loosen screw thread connections. Navy-type copper and brass tubing is supplied in various gauges to serve all pressure requirements. Braze-type fittings joined with silver solder are generally stronger than the tubing itself. Navy-type tubing is often half the weight of threaded pipe for the same sizes. Because of low internal friction it is sometimes possible to use correspondingly smaller sizes of tubing than pipe. Thus, dead weight can be replaced with valuable cargo. Among marine applications are auxiliary steam lines, condensate and air piping, lubricating oil lines, and smoke detectors.

Note: Bridgeport products are supplied in accordance with existing priority regulations.

BRIDGEPORT BRASS

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ARMY E NAVY

BRASS

ESTABLISHED 1865

. . . in thousandths of an inch

Mechanical protection of boiler tubes and drums for long periods of time is provided by a brush-applied coating only a few thousandths of an inch thick. This coating is APEXIOR NUMBER 1, a chemically-inert, boiler water and steam resistant paint especially developed for metal surfaces.

Applied by hand brush or power coater, APEXIOR fills the metal pores and joints, preventing contact between metal and water or steam, thus greatly improving internal boiler conditions. APEXIOR also

1. Makes cleaning easier and required less often;
2. Prevents chemical bonding of dirt and scale;
3. Assures better heat-transfer over extended period by keeping boiler cleaner;
4. Prevents acceleration of stress corrosion or embrittlement due to water contact.

THE COATING IS EASILY MAINTAINED

Use of APEXIOR NUMBER 1 as a protection for boiler metal is recommended by all U. S. and Canadian boiler insurance companies. It is used by steam turbine manufacturers to coat shaft and rotor bodies. It is also used on feedwater heaters and deaerators.

FOR "COLD-WET" METAL SURFACES APEXIOR NUMBER THREE

APEXIOR NUMBER 3 provides similar protection for metal surfaces that are exposed to water or moisture at any temperature under 125°F. This special, shiny-black paint resists both fresh and salt water and can be used with potable water.

Organizations like these have used APEXIOR for years:

American Viscose Company
Bethlehem Steel Co.
Lehigh Portland Cement Co.
Firestone Tire & Rubber Co.
National Lead Co.
International Paper Co.
Gulf Oil Corporation
Carnation Co.
E. I. DuPont de Nemours & Co.
Omaha District Utilities

To learn what APEXIOR brush-applied protection can mean to you, write for Bulletin 1290, to the Dampney Company of America, Hyde Park, Boston 36, Massachusetts. *Main Office:* Hyde Park, Boston, Mass., *Branch Offices:* Atlanta, Chicago, New York, Detriot, Philadelphia. *Engineering Sales Representatives*—Cincinnati, New Orleans, San Francisco, Los Angeles, Portland, Seattle, Phoenix, Denver, Salt Lake City, Dallas, Houston, Vancouver, B.C., Montreal, P.Q., Havana, Cuba, Honolulu, T. H. *Marine Dept.*, 114 Liberty Street, New York 6, N.Y.

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The **DAMPNEY COMPANY** of America
protective coatings for
STATIONARY BOILERS, LOCOMOTIVES AND STEAMSHIPS

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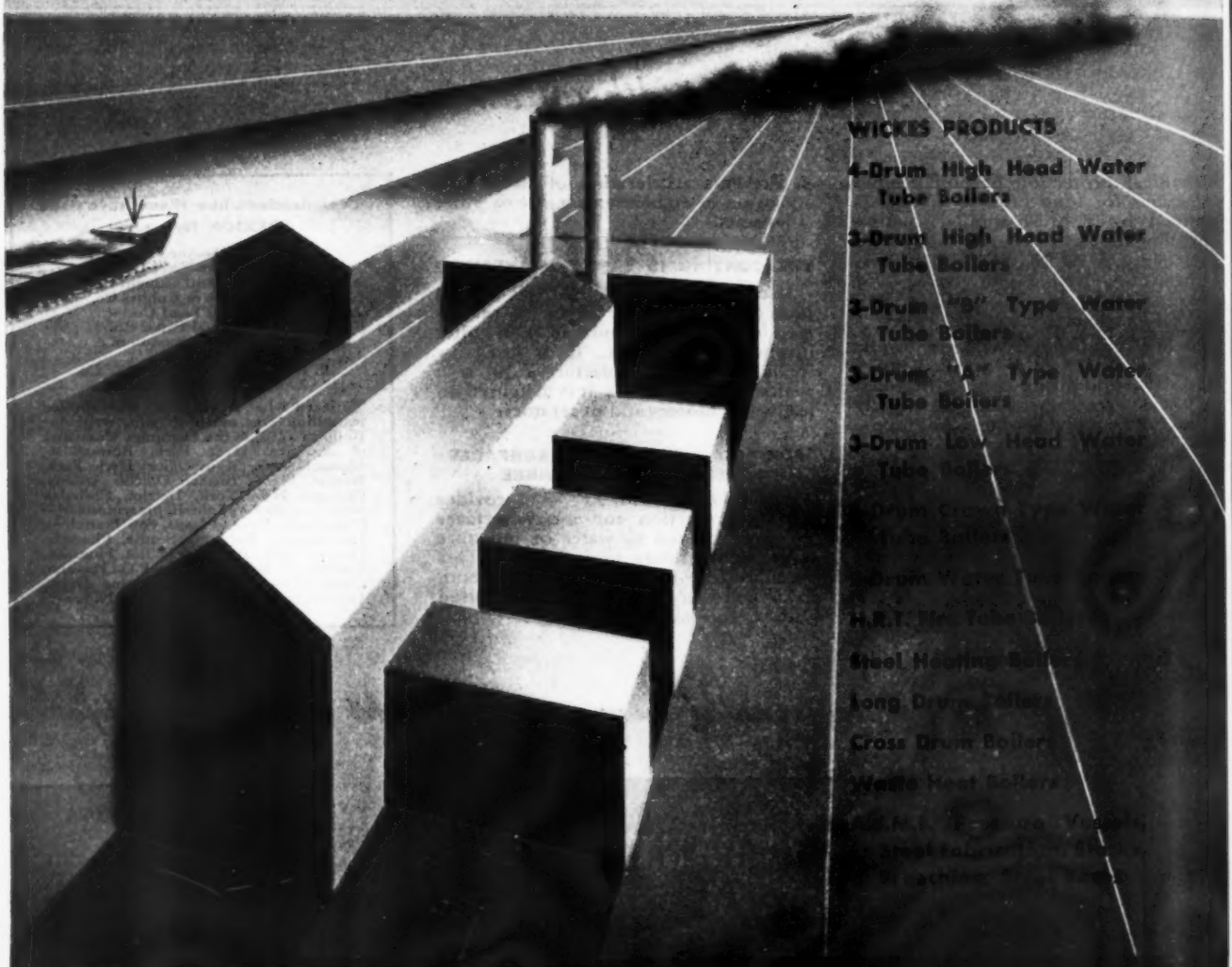
Company.....

Address.....

WICKES FACILITIES AVAILABLE FOR TOMORROW'S BUSINESS PLANS

The complete metal fabrication facilities of the Wickes Boiler Co. have produced boilers and pressure vessels for important industrial installations the world over. Wickes engineers, modern equipment, and skilled workmen are now available to fill your requirements for boilers of any type up to 250,000 lbs. of steam per hour and 850 psi. All types of heavy welded plate fabrication for oil, chemical, paper and other industrial uses.



WICKES PRODUCTS

4-Drum High Head Water Tube Boilers

3-Drum High Head Water Tube Boilers

3-Drum "B" Type Water Tube Boilers

3-Drum "A" Type Water Tube Boilers

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Cross Drum Boilers

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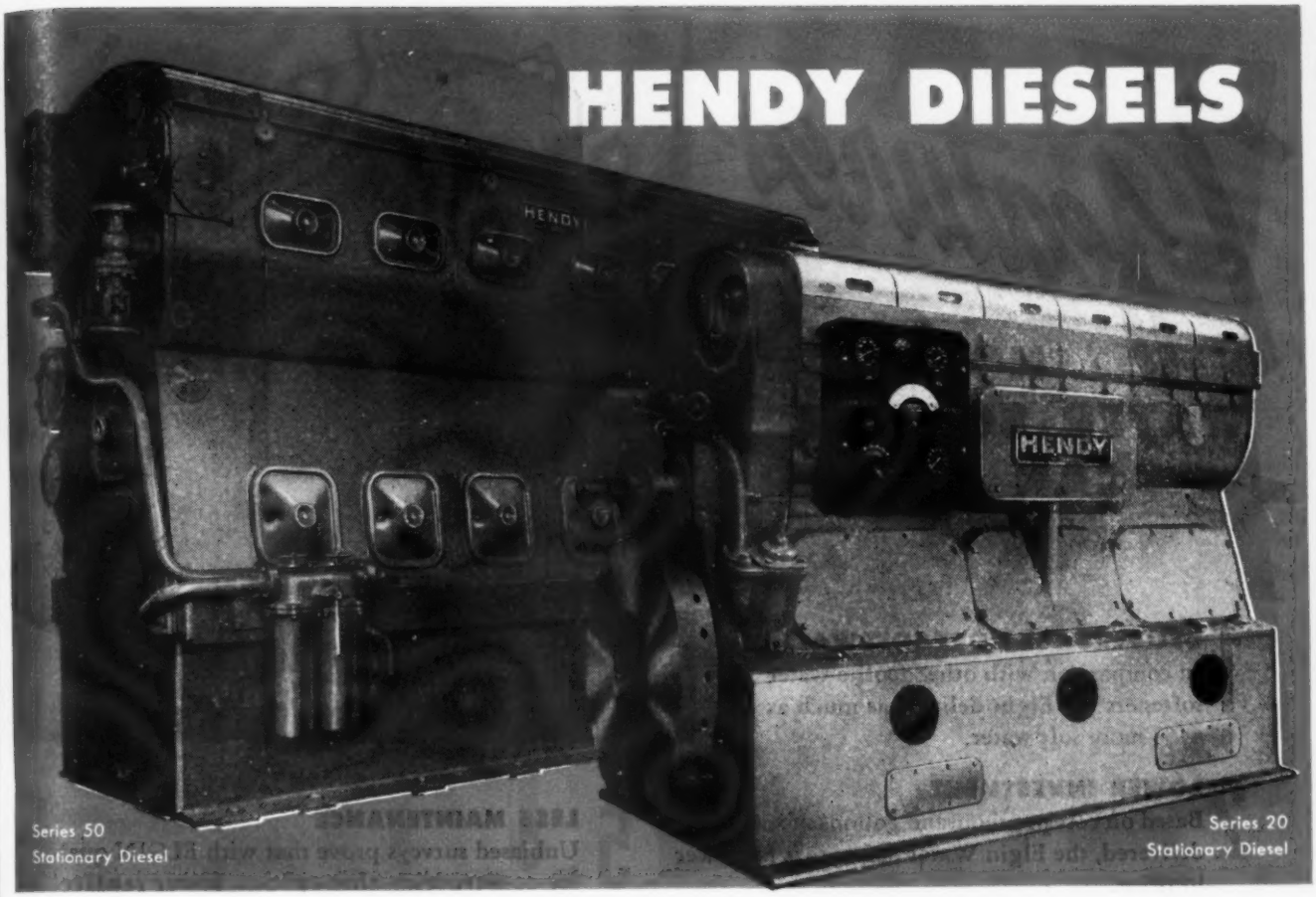

now available from 125 to 780 horsepower

Industrial operators are finding that in Hendy Diesels there is *more* than meets the eye. Besides their clean-cut appearance, they embody many features never before available in any one engine.

DEPENDABILITY: Unit-type fuel pumps and injectors eliminate high-pressure fuel lines and danger of air-locks. Overhead camshafts eliminate many moving parts and give quiet, reliable valve and fuel-pump action. Full pressure lubrication to moving parts assures the correct amount of oil at the right places, automatically.

ACCESSIBILITY: Fuel-transfer, lubricating-oil and cooling-water pumps, oil coolers, fuel and lube-oil filters are *conveniently* located and instantly accessible. Large inspection-doors, which can be removed without disturbing any other assemblies, give easy access to crankshaft and connecting-rod bearings.

LONGER LIFE: The conservative ratings and heavy-duty characteristics of these engines assure long life and smooth operation. The crankshaft, which is large and well proportioned, is supported by large, replaceable, bronze-backed bearings, all of which receive positive pressure lubrication.

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ESTABLISHED 1856
SUNNYVALE, CALIFORNIA

GENERAL SPECIFICATIONS

SERIES 20

125 to 260 hp; 600 - 900 rpm; Air starting.

SERIES 50

350 to 780 hp; 350 - 500 rpm; Air starting; Dual intake and exhaust valves.

OPTIONAL EQUIPMENT

includes: Clutch power take-offs from either end; Engine-driven starting-air compressor; Closed-circuit cooling system.

Also available as complete generating plants.

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Latest design Elgin Water Softener

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In comparison with other zeolite water softeners the Elgin delivers as much as 44% more soft water.

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Based on cost per thousand gallons of soft water delivered, the Elgin Water Softener is far lower in price.

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By virtue of an improved distributing and collecting system, less regenerating salt and wash water are required.

4 HIGHER EFFICIENCY
The water softening zeolite in the Elgin is kept clean and active so that equipment operates more efficiently without attention—and more "zero-soft" water is delivered per pound of salt used.

5 LESS MAINTENANCE
Unbiased surveys prove that with ELGIN quality construction throughout, fewer replacements are required. Loss of zeolite is prevented, thus eliminating costly additions.

6 LONGER LIFE
Efficient distribution, collection and regulation of water and brine add years to the life of Elgin Water Softeners.

7 LESS SPACE REQUIRED
To give the same capacity as an Elgin, other water softeners must be as much as 50% larger in size.

WHY THE ELGIN GIVES GREATER CAPACITY AND HIGHER EFFICIENCY

There is nothing mysterious about the increased soft water output and the higher efficiency of the Elgin Water Softener. It simply accommodates a far greater quantity of water softening zeolite and uses it more effectively by virtue of an ingenious manifold system and backwash regulator. Naturally a greater volume of soft water is delivered because it's the zeolite that softens water—and more zeolite used with greater effectiveness means more softened water. Add to this the outstanding quality and the high capacity feature of Elgin water softening zeolite and you have the whole story in a nutshell.

Bulletin 603 gives all the facts. Write for your copy today.

Existing water softeners of any make can be modernized by Elgin to provide the above features.

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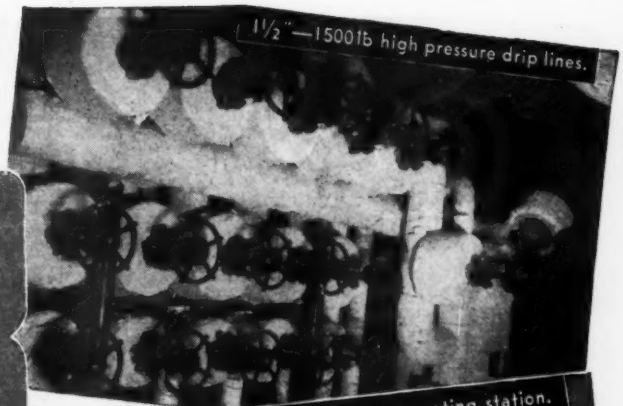
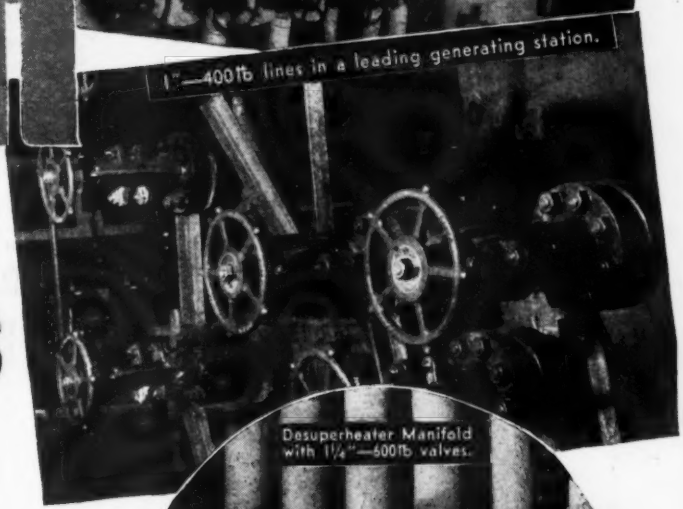
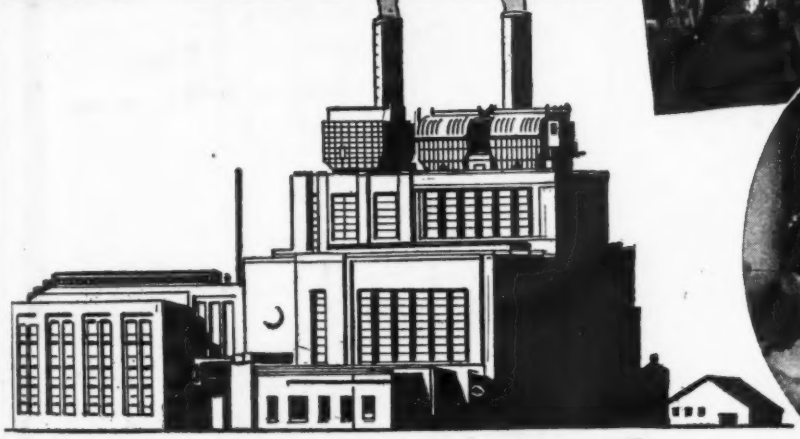
SOFTENERS ★ FILTERS ★ WATER TREATMENT ★ BOILER WATER CONDITIONING

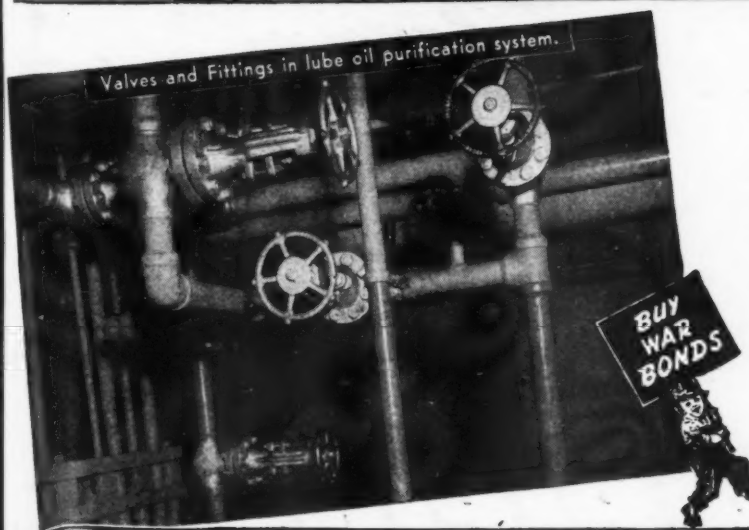
Uninterrupted POWER *for* WAR INDUSTRIES


1½"—1500lb high pressure drip lines.


1"—400lb lines in a leading generating station.

Desuperheater Manifold with 1¼"—600lb valves.

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● **SAFE and SURE control of vapors and liquids in steam generating plants serving our War Industries is dependent on piping materials having an inherent "plus" of strength and toughness. *Drop Forged Steel* Valves, Fittings, and Flanges made by Vogt continue to play a vital part in the smooth, efficient operations of America's leading power plants.**

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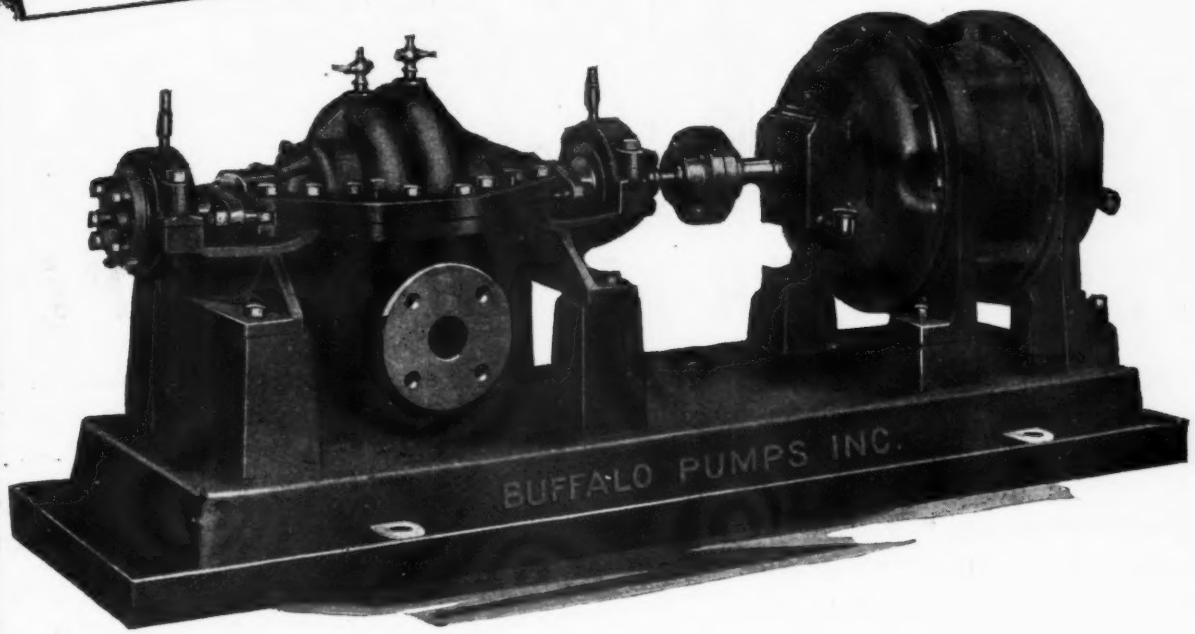

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When you install a "Buffalo" Pump in its rated job, you're bound to enjoy all these "efficiency factors" . . . *years* of operation at high delivery for your power dollar . . . with practically no servicing. That all adds up to *efficiency*, which is no accident in "Buffalo" Pumps! Years of *practical* research and production by "Buffalo" experts have made "Buffalo" Pumps the by-word in dependability they are today. Their accurately machined shafts, bearings and rotors, their hydraulic balance, their scientific, proven design . . . every detail . . . is okayed by Buffalo engineers only after exhaustive testing. You're sure of fine performance with "Buffalo" Pumps!

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TIME FOR A CHECK-UP!

Don't put off the inspection of your heating system until the "feel of Fall in the air" reminds you that another heating season is just around the corner. Remember, repairs and replacements that you could have delivered almost overnight a few years ago take more time today.

Get to work now. Make a thorough inspection of your heating system — while the steam is off . . . Examine radiator trap interiors. They may be wasting valuable fuel . . . Here's what to look for—and what to do about it.

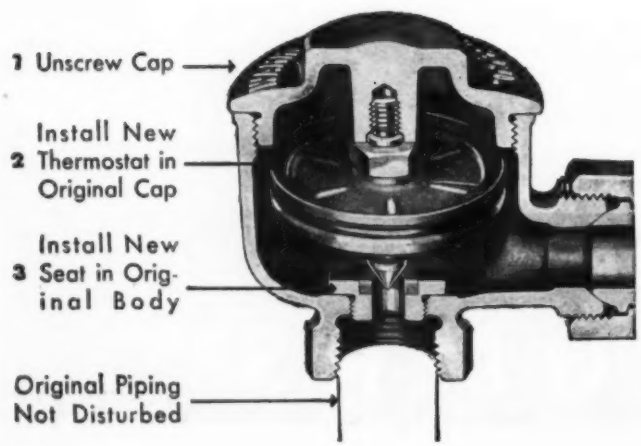
Dirt or scale in Seat opening may prevent closing of trap and allow uncondensed steam to escape into return piping . . . Wipe seat and valve clean with rag dipped in kerosene.

Nicks or wear on Valve Seat may cause steam leakage . . . Replace all worn or nicked seats.

A Trap Thermostat that, from long use or excessive working pressures, remains permanently expanded, means a cold radiator . . . Install new thermostat.

The installer can repair Webster Traps right on the job . . . can restore radiator traps to 100% efficiency, insuring against waste of "live" steam or loss of valuable fuel . . . can help you get comfortable heat even with curtailed fuel supply.

We will be pleased to help you. Consult the telephone book for the address of the nearest Webster Representative.


1 Unscrew Cap
2 Install New Thermostat in Original Cap
3 Install New Seat in Original Body
Original Piping Not Disturbed

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Pioneers of the Vacuum System of Steam Heating :: Est. 1888
Representatives in principal cities :: Darling Bros., Ltd., Montreal

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STOP THIS TUBE THINNING AND EROSION

Install JOHN CRANE CONDENSER TUBE PROTECTORS

Design Features

- Resistant to contaminated salt or fresh water.
- Unaffected by temperatures to 275° F.
- Provides a Venturi entrance; reduces turbulence.
- Inner end is thin; fits tightly against tube and streamlines flow.
- Lasts for the life of the tube.
- Made for ⅝" and ¾" 16-BWG, or ⅝", ¾", ⅞" and 1" 18-BWG tubes.

Provide an armor for the inlet ends of condenser tubes and you eliminate the most common source of tube failure.

John Crane Condenser Tube Protectors answer the problem of tube end thinning. They act as a protective armor at the entrance section of the tube—*absolutely prevent all erosion and abrasion.*

These Condenser Tube Protectors are molded of a tough, wear-resistant thermo-setting plastic. Installation is easy on old or new tubes; simply slip the Tube Protector into place, in most cases without removal of waterbox head.

Service Tests on many types of Marine and Stationary Heat Exchangers prove that John Crane Condenser Tube Protectors greatly lengthen tube life, saving critical metal.

Power and Marine Engineers: Get the complete facts on the John Crane Condenser Tube Protector.

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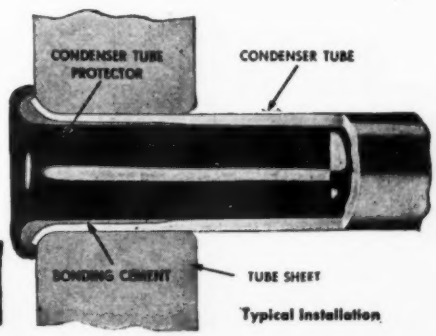

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Here's Why

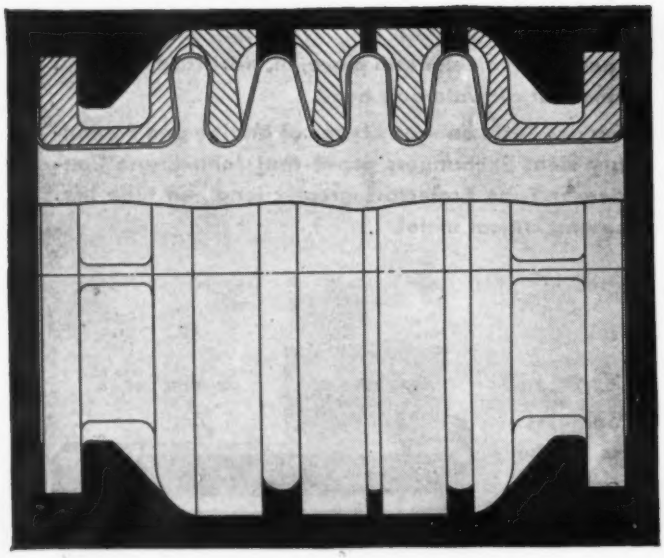
Zallea improved duo-equalizing* expansion joints endure in service!

THESE diagrams show what happens to two types of corrugated expansion joints in a contracting or expanding pipe line. Both joints have moved the same amount, but note the *individual* movement of the several corrugations. In the ordinary self-equalizing joint, one corrugation is completely closed, the next has not moved at all and the other two have moved only partially; but in the duo-equalizing joint each corrugation has absorbed the same amount of movement.

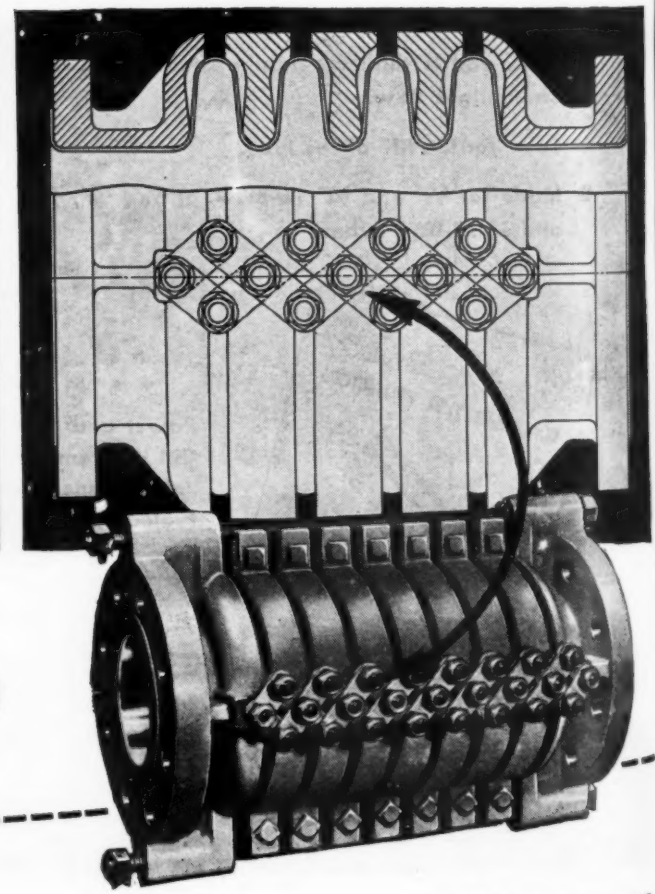
In the new Zallea Improved Duo-Equalizing Packless Expansion Joint, pantograph chain linkage guarantees equality of corrugation movement. These chains link all corrugations together so that each one must move equally and simultaneously with all others, during either expansion or contraction of the line. That's why they endure in the severest service.

Made of copper, stainless steels, and other corrosion resistant alloys . . . traverse up to 7½" . . . for pressures from vacuum to 300 psi . . . for temperatures from sub-zero to 1600° F. For complete description and specifications write for Bulletin 45.

Self-Equalizing Joint



Duo-Equalizing Joint



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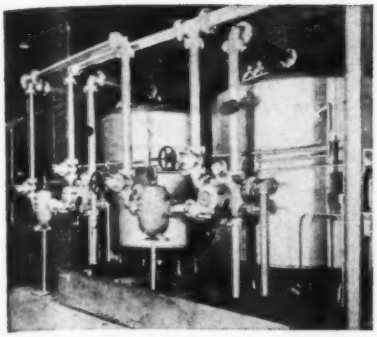
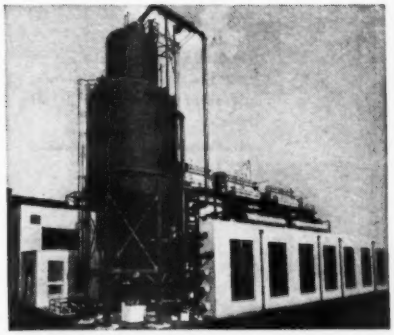
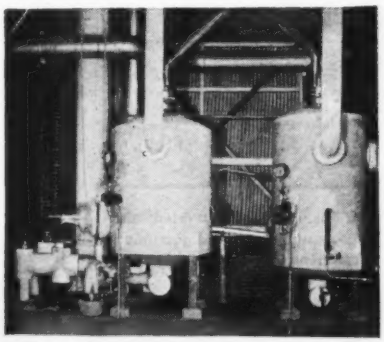
"WHAT A LINE-UP TO KEEP BOILERS ON THE LINE!"



PERMUTIT ZEO-KARB* H—Removes both hardness and bicarbonates from water. Effluent contains no encrustants, is reduced in total solids and alkalinity. Alkalinity can be adjusted by mixing effluents from a Zeo-Karb H unit and a sodium zeolite unit.



DEAERATING HEATER—Prevents corrosion by removing oxygen and free CO_2 from feedwater. Designed for pressures up to 100 pounds or higher, capacities to 1,400,000 pounds per hour or higher. Utilizes bled or exhaust steam.



CONTINUOUS BLOWOFF—Reduces foaming and priming. Maintains uniform concentration of salts in the boiler salines. Both high and low flash types. Heat from blowoff water is recovered by means of flash tanks and heat exchangers.

Permutit prevents boiler scale and corrosion . . .

Hardness and other impurities in feedwater spell trouble for war-strained power plants. But not if they're Permutit*-equipped! Permutit *removes* the impurities before the water enters the boilers!

Permutit is the world's largest maker of water conditioning equipment. Write us about *your* water problem. Address: The Permutit Co., Dept. A3, 330 West 42nd St., New York 18, N. Y., or Permutit Co. of Canada, Ltd., Montreal.

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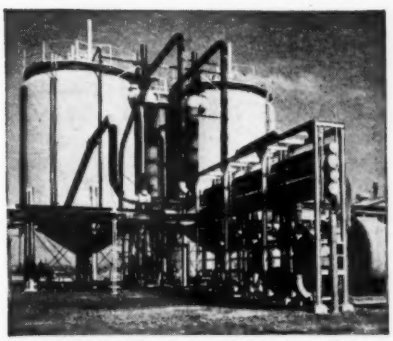
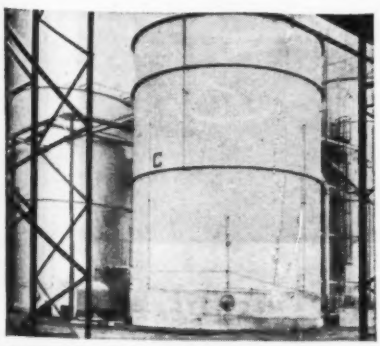
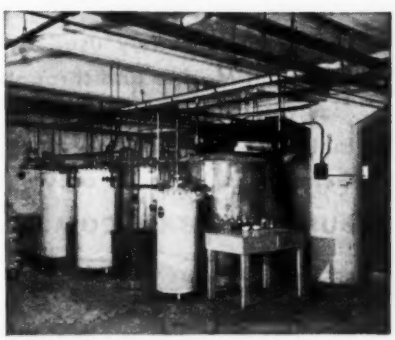


HOT LIME SODA—Lime and soda ash precipitate bulk of water hardness as calcium carbonate and magnesium hydroxide. Sludge is settled out and water filtered. Integral deaerator deaerates the water.



SILICA REMOVAL—Silica content is reduced, and deposits are eliminated. Reagents used are low in cost, do not add soluble by-products.

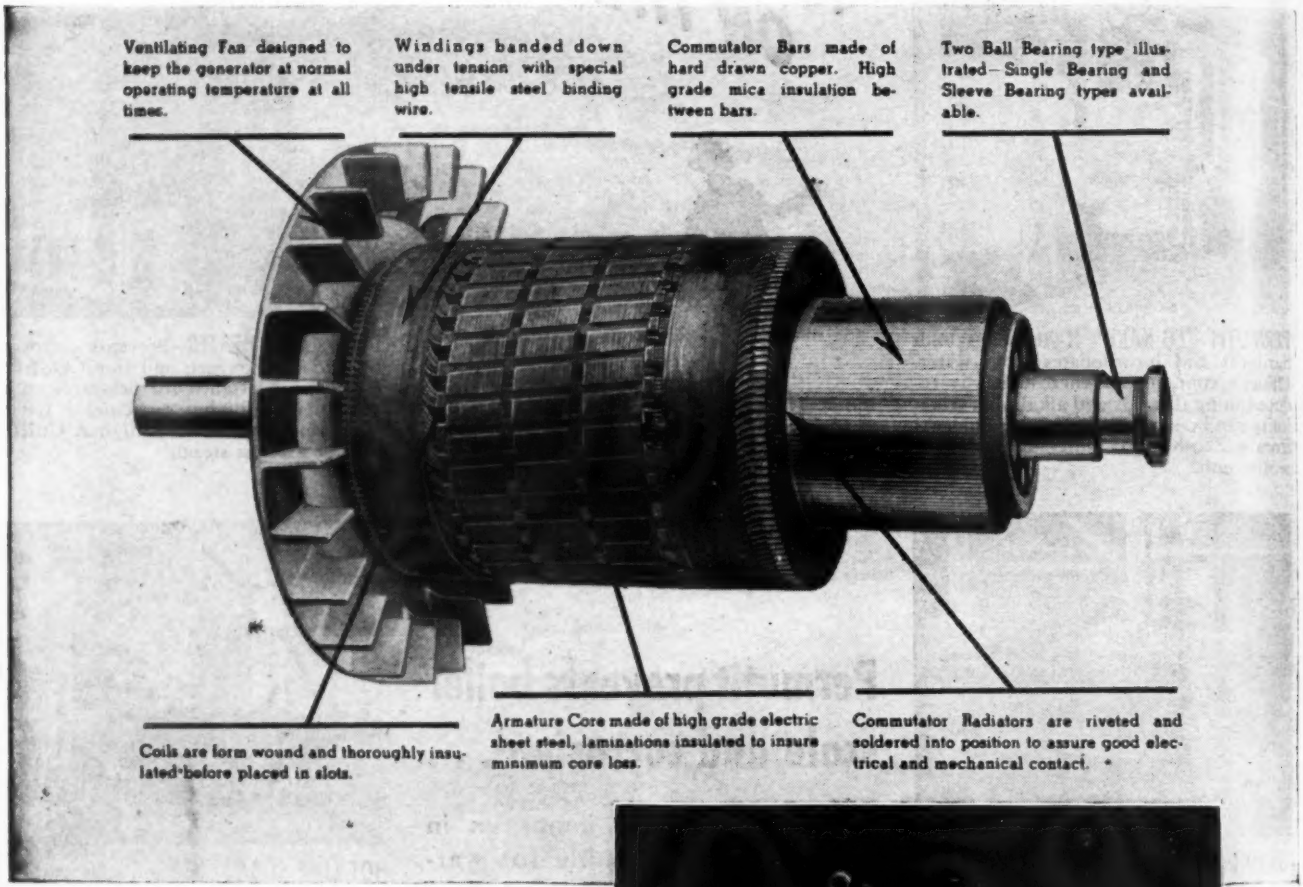


DEMINERALIZERS—By a simple process in the cold, Permutit Demineralizers produce a water practically free of salts—a low-cost substitute for evaporated water.

PERMUTIT

WATER CONDITIONING HEADQUARTERS

BURKE *54 years* of D. C. EXPERIENCE


Ventilating Fan designed to keep the generator at normal operating temperature at all times.
Windings banded down under tension with special high tensile steel binding wire.
Commutator Bars made of hard drawn copper. High grade mica insulation between bars.
Two Ball Bearing type illustrated—Single Bearing and Sleeve Bearing types available.
Coils are form wound and thoroughly insulated before placed in slots.
Armature Core made of high grade electric sheet steel, laminations insulated to insure minimum core loss.
Commutator Radiators are riveted and soldered into position to assure good electrical and mechanical contact.

BURKE 2-Bearing Type D. C. Generators illustrated, are built for belt or direct drive use from 1750 to 450 r. p. m. and for any voltages from 32 to 250. This general purpose generator is widely used by the Navy and Merchant Marine and throughout industry.

A few features are described above and bulletin 600 covers all types of Burke D. C. Generators. Write for copy.

BURKE ELECTRIC COMPANY • ERIE, PA.

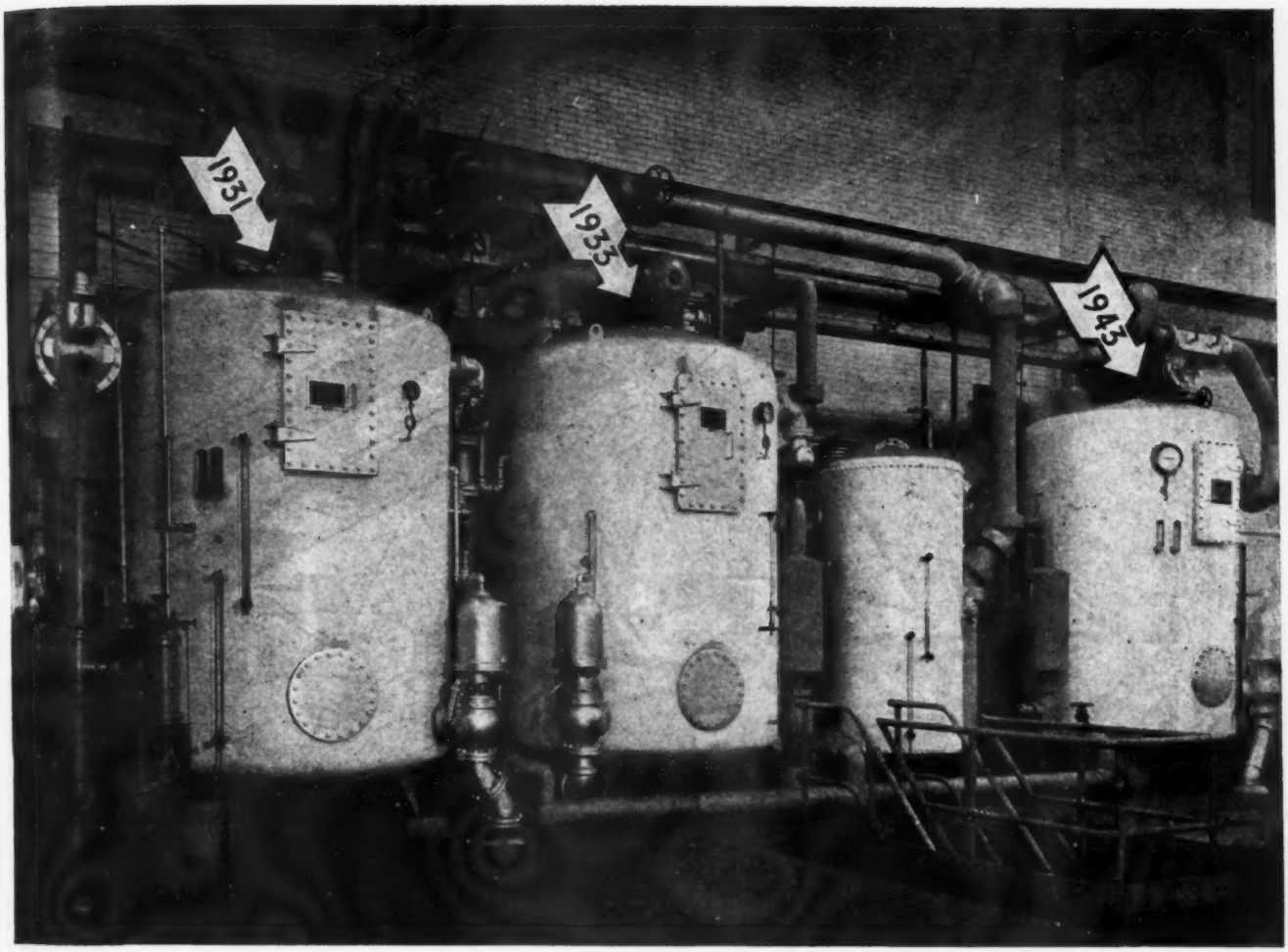
ARMY E NAVY

★ SYNCHRONOUS MOTORS AND GENERATORS
★ INDUCTION MOTORS
★ D. C. MOTORS
★ D. C. GENERATORS
★ M-G SETS
★ HIGH SPEED A. C. GENERATORS

MOTORS 1 TO 1500 H. P. • GENERATORS 1 TO 1000 K. W.

BURKE A.C. & D.C. Motors & Generators

BURKE ELECTRIC COMPANY, ERIE, PENNSYLVANIA • *Since 1891*



"AND NOW THERE ARE THREE—"

A NATIONALLY known manufacturer of a famous line of food products early in 1931 installed a Cochrane Deaerator of 200,000 lbs./hr. capacity to take care of their feedwater requirements. In 1933 they found their evaporation rate running higher than the capacity of the Deaerator, and ordered a second Cochrane unit of 200,000 lbs./hr. which was connected in parallel with the first. These units functioned with customary complete satisfaction, but in 1943, with the natural expansion of the business, the evaporation was found to be running well above 400,000 lbs./hr. So another 200,000 lbs./hr. Cochrane Deaerator was installed and the three units operate in parallel, giving a total heating and deaerating capacity of 600,000 lbs./hr. *The repeated purchase of Cochrane Deaerators to keep pace with growing needs is a tribute to continuous, consistent, satisfactory performance.*

COCHRANE CORPORATION
A DIVISION OF AMERICAN ENGINEERING COMPANY

ARMY E NAVY

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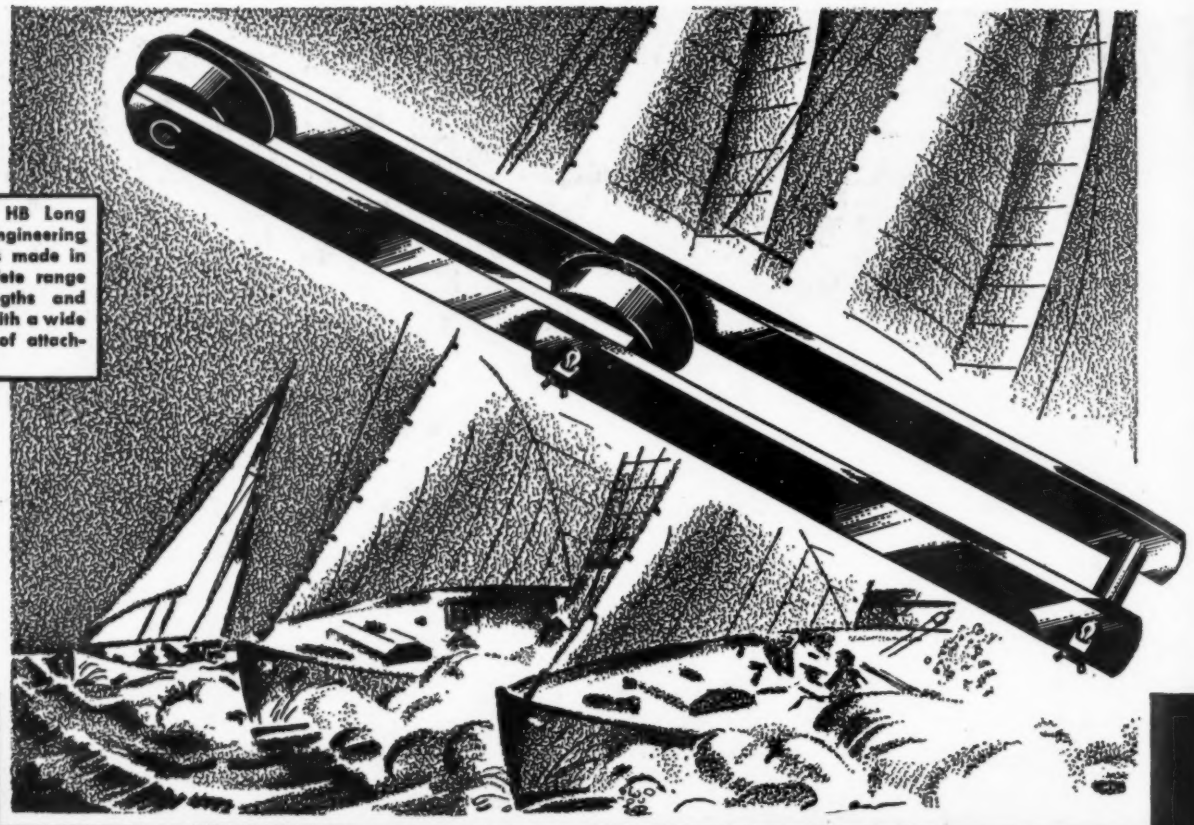
COCHRANE

SOFTENERS • DEAERATING SOFTENERS • DEAERATORS • METERS • STEAM SPECIALTIES



"Union HB Long Pitch Engineering Chain is made in a complete range of strengths and sizes, with a wide variety of attachments."

Union's Place In Chain Performance

☆ No artist can draw a picture of the race to constantly improve the performance of chain on various applications, but nevertheless, it is in constant existence. Just as yacht designers leave no stone unturned in their searching out the secrets of increased speed, so do Union Chain Engineers continue their experiments to maintain Union Chain's leadership in "performance on the job." Union Chains receive this attention because the sole interest of the Union organization is the production of a complete line of steel chain, sprockets and flexible couplings for power transmission and for the mechanical handling of material. Many buyers have reason to believe that this specialization pays dividends in trouble-free service and longer life. Place your next chain order with Union and find out if you agree.

The Union Chain and Manufacturing Company . . . Sandusky, Ohio, U. S. A.

Catalog A-2 covers Drive and Conveying Chain. B-2 covers Finished Steel Roller Chain. FC-1 covers Flexible Couplings. Ask for your copies.

ARMY ★ NAVY

UNION CHAINS

Union Chains for Every Application

Drive and Conveying Chains and Sprockets
- Bridge Chain
- Combination Malleable Iron and Steel Chain
- HB (hardened bearing) type chain
- BP (bar and pin) type chain

★

Finished Steel Roller Chains and Sprockets
- All manufacturer's standard, size ⅜ in. to 2½ in. pitch
- Single and Multiple Strands
- Extended Pitch Series in sizes 1¼ in. to 4 in. pitch

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Silent Chain and Sprockets
- All sizes ⅜ in. to 1½ in. pitch

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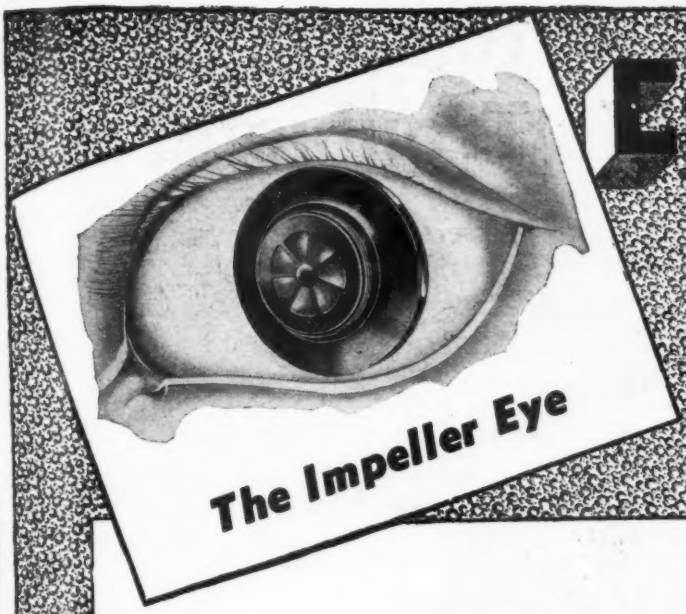
Flexible Couplings
- Roller chain type
- Silent chain type



COFFIN TURBO PUMPS

The single stage, patented, impeller of Coffin Turbo Pumps has a much smaller annulus diameter than the conventional axial inlet impeller of equal capacity.

This greatly lowers the peripheral speeds of the wearing surfaces and reduces wearing ring leakage.

For Full Particulars Mail The Coupon

THE J. S. COFFIN, JR., CO

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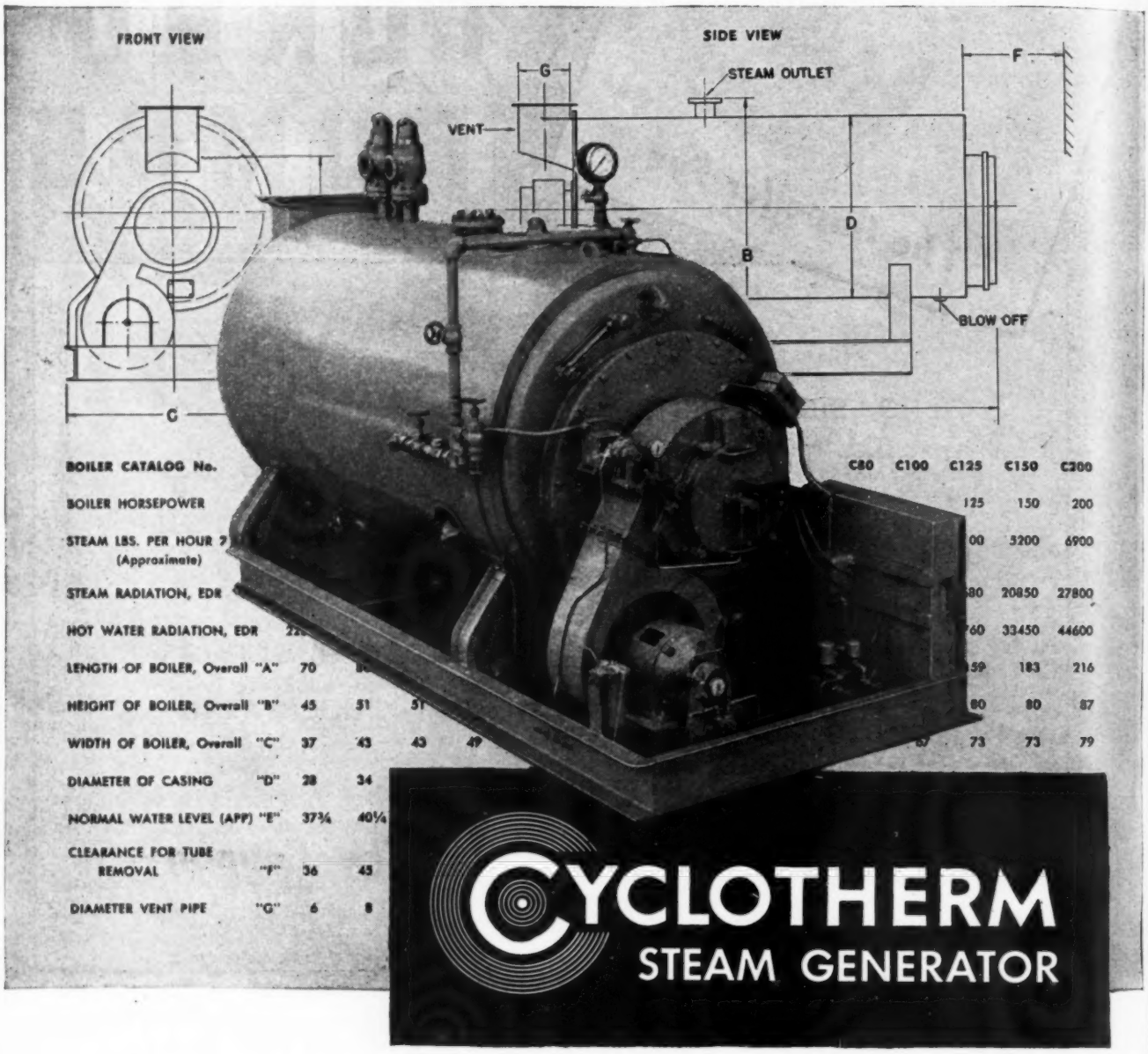
P. W.

A Self-Contained Automatic Steam Generator That Is Trouble Free



BOILER CATALOG No.		C80	C100	C125	C150	C200
BOILER HORSEPOWER				125	150	200
STEAM LBS. PER HOUR (Approximate)				00	3200	6900
STEAM RADIATION, EDR				80	20850	27800
HOT WATER RADIATION, EDR				60	33450	44600
LENGTH OF BOILER, Overall	"A"	70		59	183	216
HEIGHT OF BOILER, Overall	"B"	45	51	80	80	87
WIDTH OF BOILER, Overall	"C"	37	43	73	73	79
DIAMETER OF CASING	"D"	28	34			
NORMAL WATER LEVEL (APP)	"E"	37¾	40¼			
CLEARANCE FOR TUBE REMOVAL	"F"	36	45			
DIAMETER VENT PIPE	"G"	6	8			

Unique application of combustion principles enables the designers of Cyclotherm Steam Generators to provide a combustion chamber and tube arrangement that assures a more rapid water circulation than is possible in a conventional boiler. The conventional boiler requires many times more secondary heating surface, and a number of passes and repasses to attain equal operating efficiency. Cyclotherm's rapid circulation provides a "washing" effect that tends to keep the submerged tubes free from scale.

That is one of many reasons contributing to a long and efficient life of trouble-free operation for a Cyclotherm unit.

Cyclotherms range from 10 HP to 200 HP. They are completely self-contained, automatic, oil or gas fired. They require no special foundation or stack and come to you fully assembled after testing.

Because thousands of units have been employed by the Army, Navy and Marine Corps under all kinds of service conditions, Cyclotherm is emerging from the war with a veteran's reputation for delivering results. Orders are now accepted for early delivery.

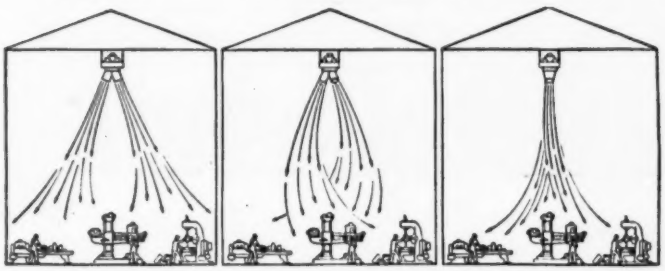
CYCLOTHERM CORPORATION · 90 BROAD STREET, NEW YORK 4, N. Y.

Cooling with Heaters!

WING
REVOLVING
UNIT HEATERS
• (WITH STEAM TURNED OFF)

Keep Workers Cool, Comfortable and Invigorated . . .

THE same virtues that make Wing Revolving Unit Heaters the ideal means of heating a plant or building are responsible for their unparalleled success in summer cooling. With heating sections turned off and only the fans operating, the discharge outlets revolve slowly, just as they do for the distribution of heated air, projecting a cooling stream of air to the working level, sweeping slowly around and under machinery and other obstacles, relieving the oppressive, stagnant atmosphere, bringing renewed vigor to the workers.



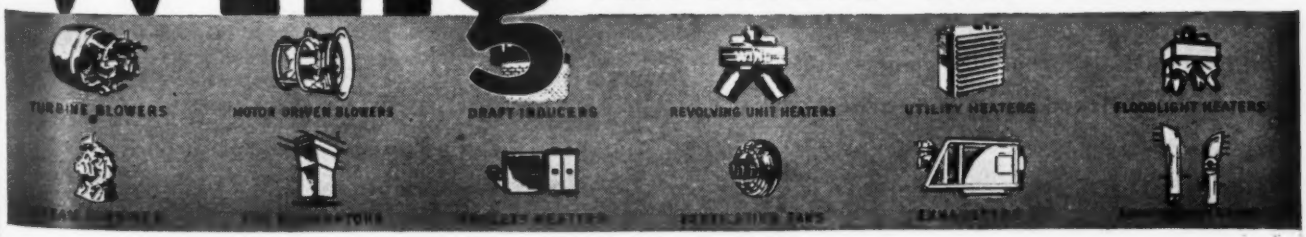
AIR STREAM REVOLVES SLOWLY, CREATING A GENTLE, COOLING BREEZE

WHY THE REVOLVING DISCHARGE IS SUPERIOR • FOR BOTH HEATING AND COOLING •

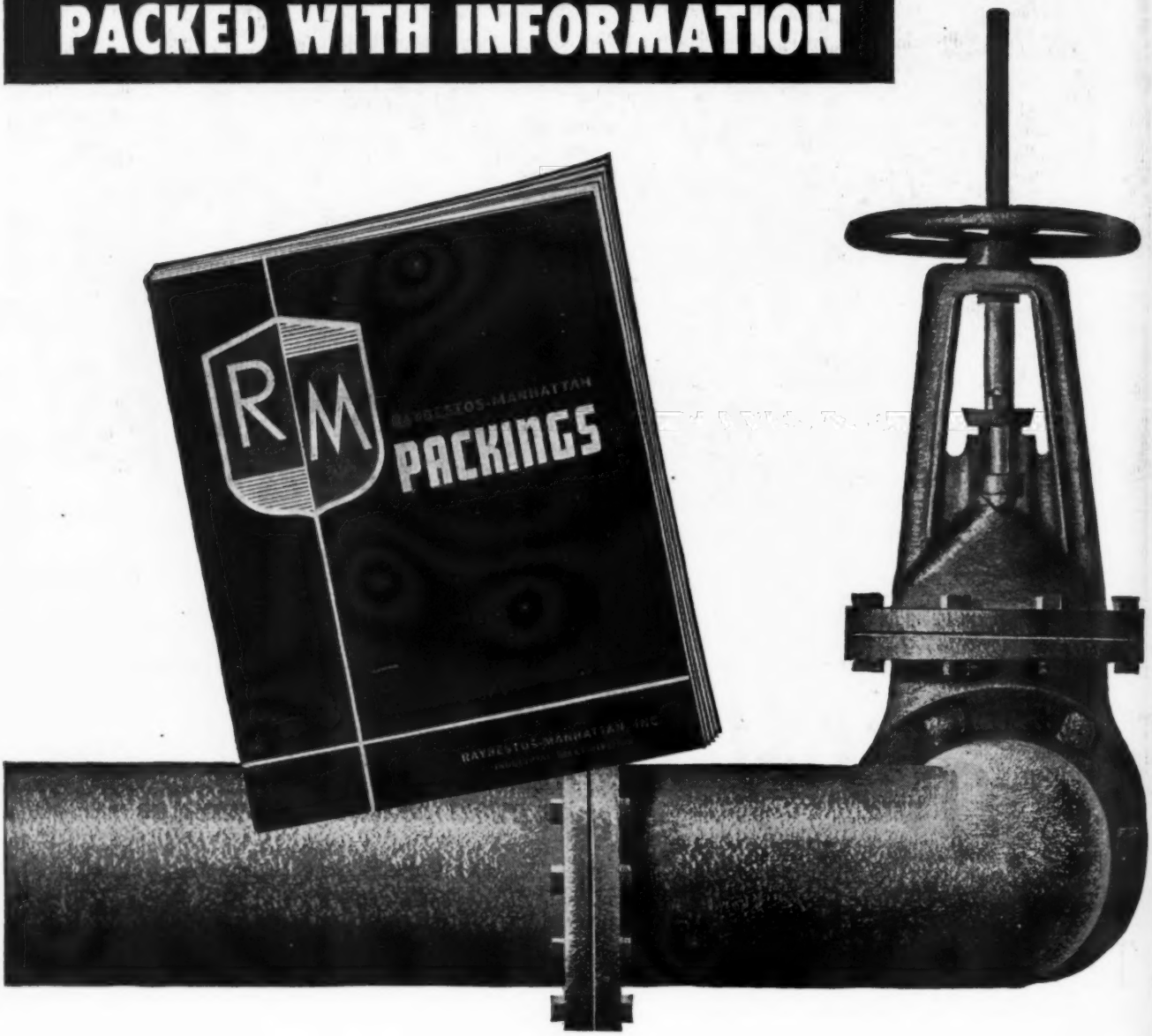
The exclusive Wing revolving discharge secures its uniform, even distribution because it moves slowly through the full 360° of a circle, thereby spreading the streams of air to all sides and corners of room or building, circulating over, under and around obstructions and creating a gentle, pleasant movement of the air around the workers. In winter, this movement of the heated air warms pleasantly, while avoiding hot blasts. In summer, it cools by keeping the air in motion, the best-known method of cooling.

L. J. Wing Mfg. Co. 50 7th Ave., New York 11, N. Y.

Wing REVOLVING UNIT HEATERS



PACKED WITH INFORMATION



IF YOU USE PACKING, send for a free copy of the R/M book . . . 48 pages . . . 45 illustrations . . . chart showing proper type of packing for every industrial use . . . complete dimensions, weights, and descriptions of more than seventy types of packing . . . in hundreds of different sizes.

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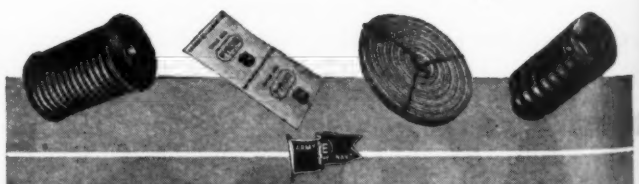

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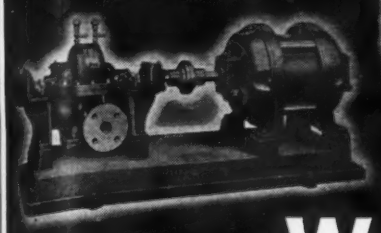
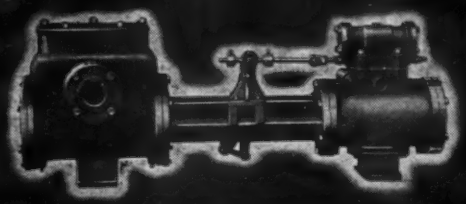
It's "Packed with Satisfaction"—When You Use R/M

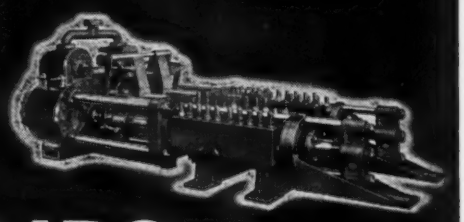
Warren Two-Stage Volute Centrifugal Pump





Warren Steam Heat Vacuum Pump

Warren Horizontal Duplex Hydraulic Pump



WARREN PUMPS

for Post-War Planning Include:

CENTRIFUGAL

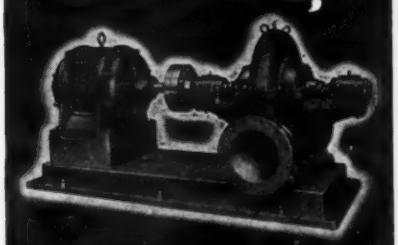
Single and multi-stage
Pressure range: 0 to 850 P. S. I.
Capacities: 0 to 36,000 G. P. M.
Types: Horizontal & Vertical
Impellers: Open or enclosed
Casings: Horizontal or Vertical Split, cast iron or bronze
Bearings: Sleeve or ball-bearing

RECIPROCATING

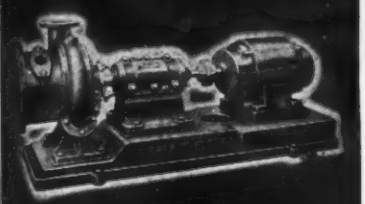
Horizontal and Vertical single piston
Horizontal and Vertical duplex piston
Single and Duplex Outside Packed Plunger
Single, Duplex and Compound Hydraulic
Steam Heat Vacuum
Automatic Pump and Receiver, etc., etc.

Send your pumping problem to us; our Engineers will recommend the right pump for the job.

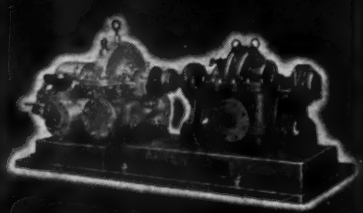
Warren Type "L" Single-Stage Single-Suction Liquor Pump



Warren 14-in. Single-Stage Double Suction Pump



Warren Heavy Liquid Centrifugal Pump



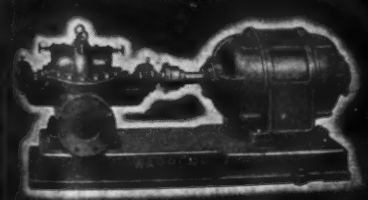
Warren Two-Stage Volute Centrifugal Pump

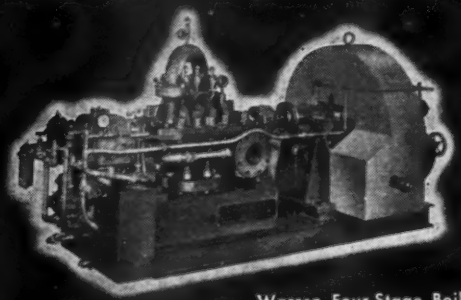
ARMY E NAVY

WARREN STEAM PUMP COMPANY, INC.

WARREN, MASSACHUSETTS

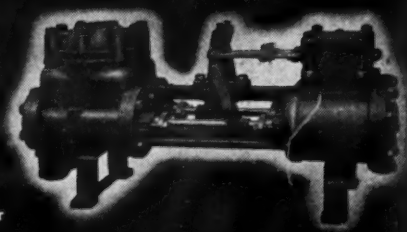
Warren Single-Stage High Speed Centrifugal Pump



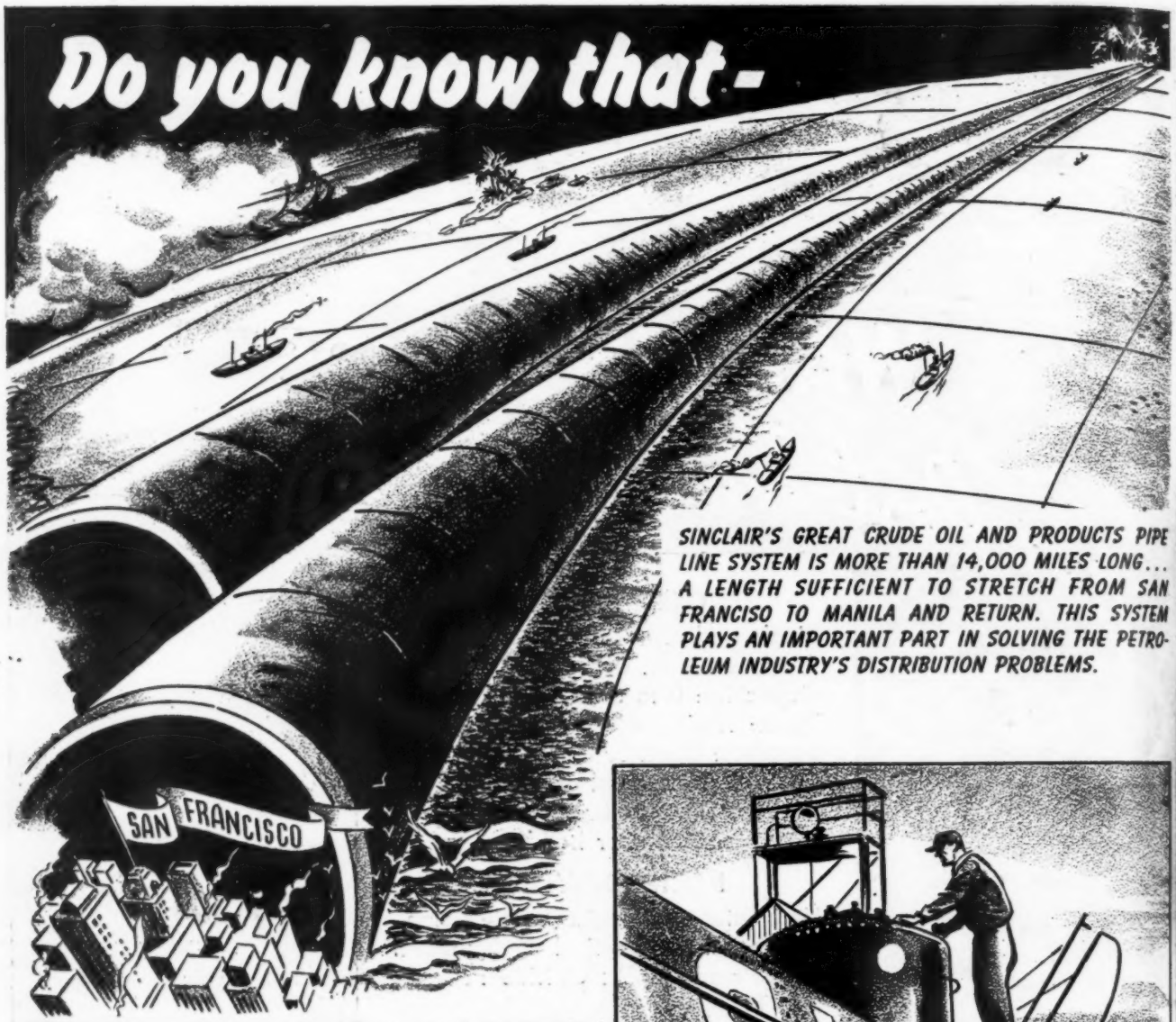


Warren Four-Stage Boiler Feed Pump

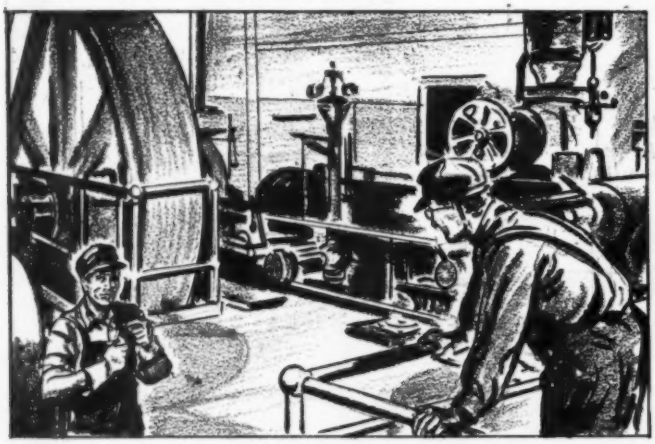
Warren Horizontal "Realwear" Duplex Piston Pump



Do you know that-



SINCLAIR'S GREAT CRUDE OIL AND PRODUCTS PIPE LINE SYSTEM IS MORE THAN 14,000 MILES LONG... A LENGTH SUFFICIENT TO STRETCH FROM SAN FRANCISO TO MANILA AND RETURN. THIS SYSTEM PLAYS AN IMPORTANT PART IN SOLVING THE PETROLEUM INDUSTRY'S DISTRIBUTION PROBLEMS.



ECONOMIC LUBRICATION UNDER DIFFICULT STEAM PLANT CONDITIONS IS PROMOTED BY SINCLAIR STEAM CYLINDER AND VALVE OILS. THEY ADHERE TO MOVING PARTS, EMULSIFY IMMEDIATELY AND SEPARATE EASILY FOR STEAM RECOVERY.

SINCLAIR OWNS AND OPERATES MORE TANK CARS THAN ANY OTHER OIL COMPANY IN THE UNITED STATES. THEY TRAVEL MORE THAN 325,000,000 MILES ANNUALLY TRANSPORTING PETROLEUM PRODUCTS.

SINCLAIR IS EQUIPPED TO SERVE YOU BETTER!

FOR FULL INFORMATION OR LUBRICATION COUNSEL WRITE SINCLAIR REFINING COMPANY, 630 FIFTH AVENUE, NEW YORK 20, N. Y.

AT LOS ANGELES

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AT PASSAIC

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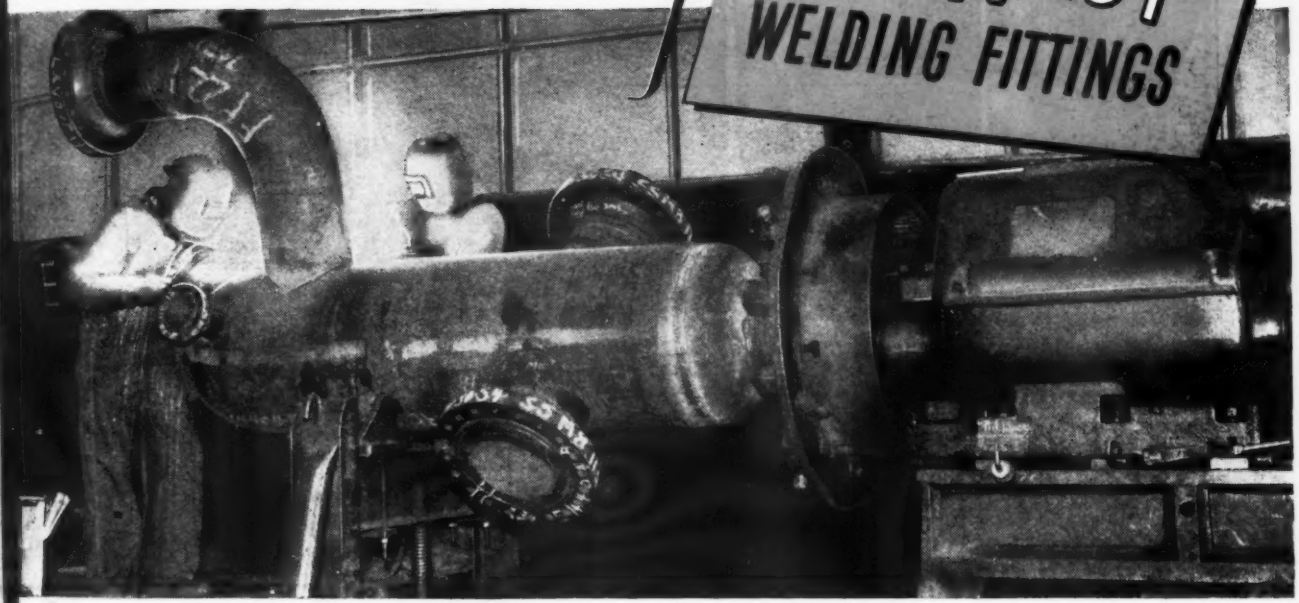
MIDWEST PIPE FABRICATING PLANTS

Make a *CONTINUOUS CHECK*

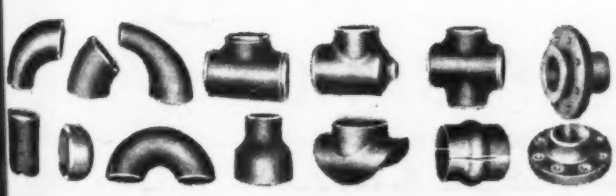
on the HIGH QUALITY of MIDWEST WELDING FITTINGS



Four modern Midwest pipe fabricating plants supply piping for all purposes and pressures to a great variety of industries from coast to coast. These Midwest plants are large users of Midwest Welding Fittings. This regular everyday use of these fittings in fabricating both simple and complex piping subassemblies provides an accurate and continuous check of their quality . . . of correct dimensions . . . of uniformity . . . of accurate angularity, etc.

But this daily use in our own fabricating plants does more than check quality . . . it makes certain that Midwest Fittings are thoroughly practical . . . that they meet the needs of modern piping practices from a design standpoint . . . that they are easy to lay out and weld. For example: the accuracy of Midwest machining methods makes it possible for the user to cut his pipe before receiving his Midwest Welding Fittings . . . he can depend upon the catalog dimensions. Buyers of Midwest Welding Fittings get the benefit of this unique situation. We sell you the same fittings we use . . . assuring you of quality fittings that are correctly designed and that save time and money on many different kinds of piping jobs. Bulletin WF-41 gives all the facts; ask for a copy.

MIDWEST WELDING FITTINGS IMPROVE DESIGN AND REDUCE PIPING COSTS

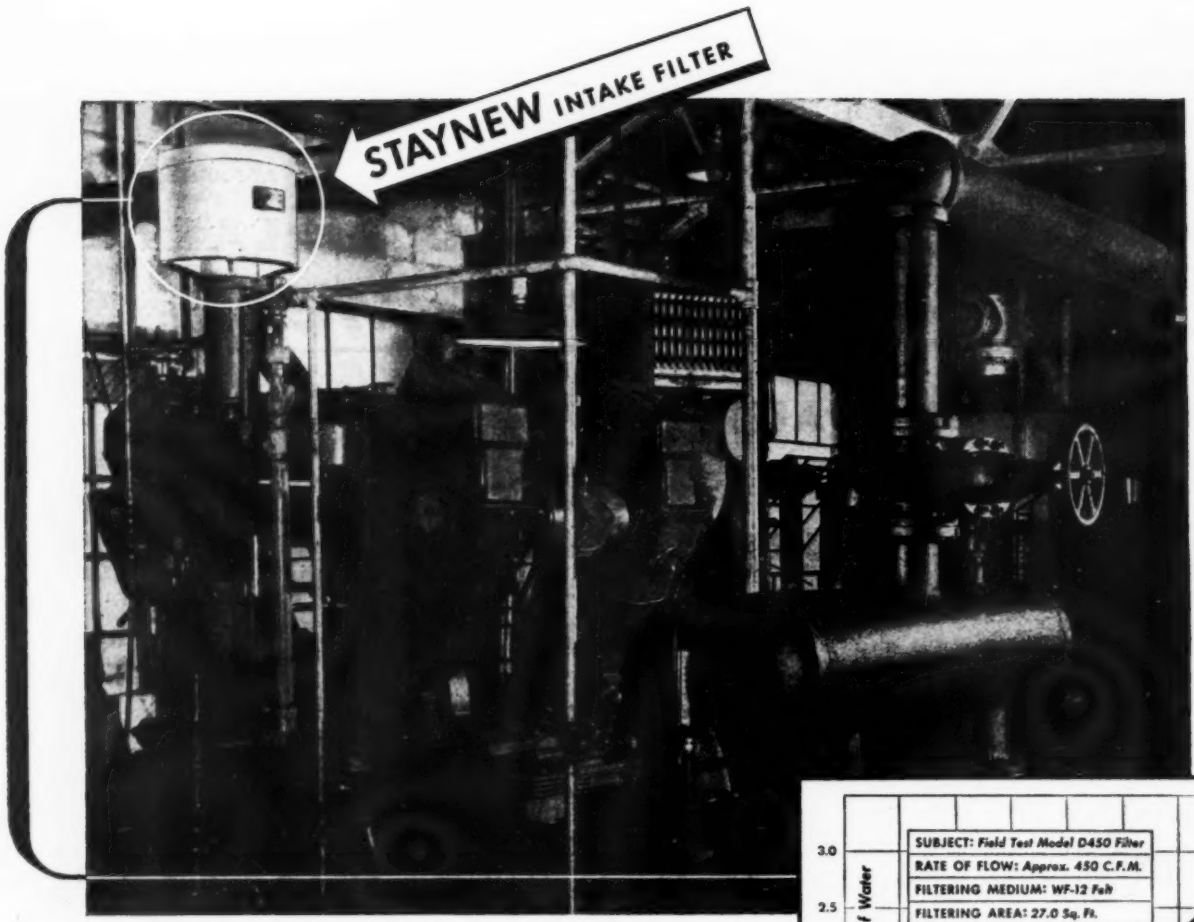


MIDWEST

PIPING & SUPPLY COMPANY, Inc.

Main Office: 1450 South Second St., St. Louis 4, Mo.

Sales Offices: New York 7—30 Church St. • Chicago 3—549 Monadnock Bldg. • Los Angeles 33—520 Anderson St. • Houston 2—229 Stark Bldg. • Tulsa 3—523 Mayo Bldg. • Atlanta 3—Red Rock Bldg. • South Boston 27—426 First St. • Distributors in Many Cities



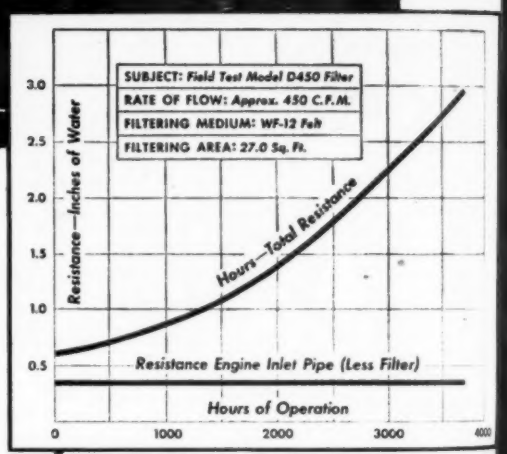
3761 HOURS CONTINUOUS OPERATION WITHOUT ATTENTION

Yet Filter Resistance Is Only 2.73 Inches of Water

This filter, installed on a Diesel-powered compressor, operates under unusually severe conditions. Intake air is heavily loaded with dust and oil; the dust due to the close proximity of a railroad siding where bulk lime, sand, and coal are handled—the oil to two additional Diesel-powered compressors operating in the same room.

Such a case history is not unusual. Reports are frequently received of Staynew Filters operating under less severe conditions for two or more years without attention—with the initially high efficiency rising as dust load increases.

Ease of cleaning as well as infrequency of cleaning is also an important feature, requiring only a few minutes with the specially designed Staynew Cleaning Nozzle.



More and more experienced operators of compressor and engine equipment specify Staynew Intake Filters—not only because of the minimum attention required, but also because these filters:

- ★ **Provide positive protection**
- ★ **Require no pre-coat or filter aid**
- ★ **Are unaffected by extremes of temperature**
- ★ **Permit use of oversize filters (air velocity not critical)**
- ★ **Are ideal for use with carbon ring compressors**

STAYNEW FILTERS

DOLLINGER CORPORATION

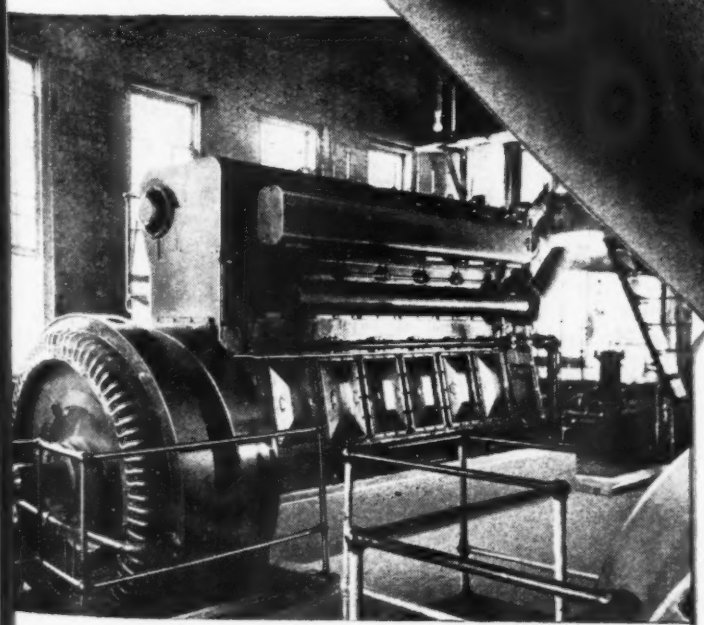
Silver Anniversary 1920-1945

(Formerly Staynew Filter Corporation)

23 CENTRE PK., ROCHESTER 3, N. Y.

Representatives in Principal Cities

A Very *Superior* Diesel



12½" x 15" Superior
Diesel Municipal Installation,
Sandersville, Georgia

SUPERIOR DIESELS • MARINE • STATIONARY • LOCOMOTIVE

Superior **ENGINES**
Division of
THE NATIONAL SUPPLY CO.
Plant and General Sales Office:
Springfield, Ohio

The First Step...

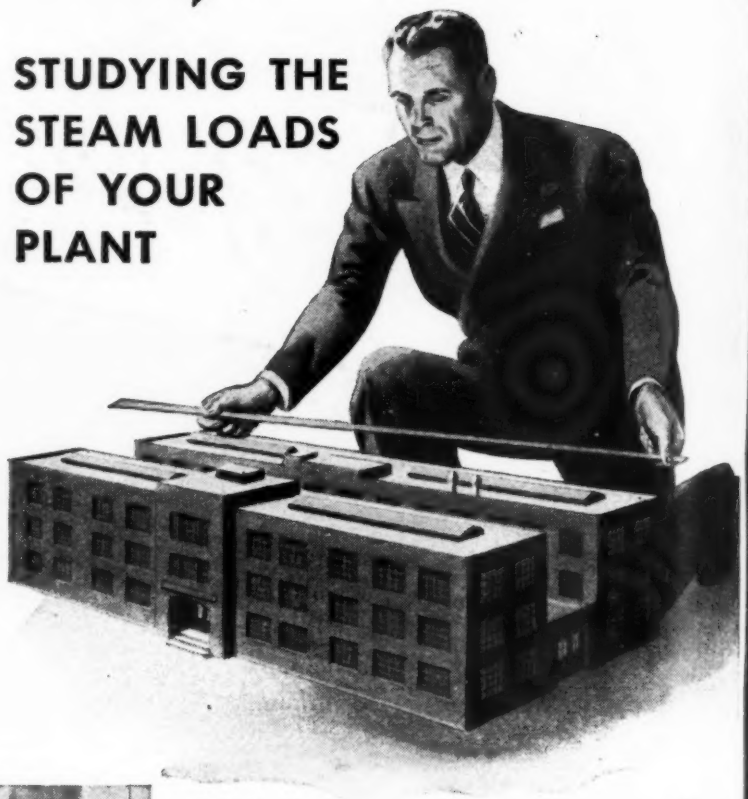
FUEL and steam costs are usually major items in production and plant operation. That's why it pays to have a steam plant designed to meet your steam loads most efficiently.

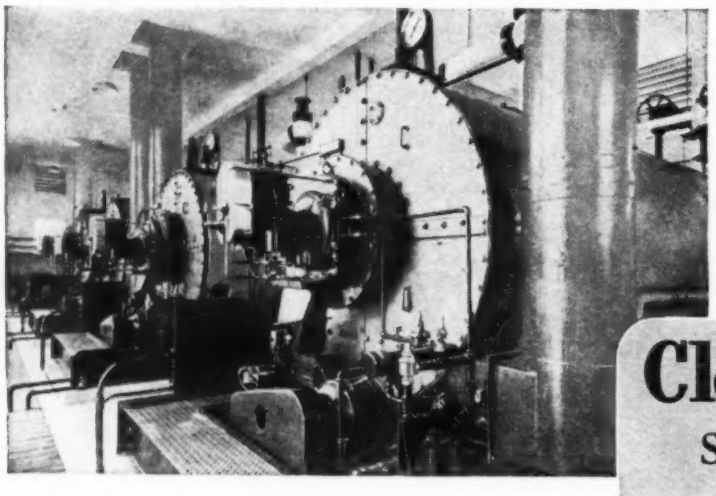
Cleaver-Brooks does not sell you a steam generator "off the shelf." Your steam requirements on the basis of present loads and future growth are first analyzed by a Cleaver-Brooks engineer and recommendations are then made for your specific needs.

With sound application engineering of this kind plus basically sound steam plant design and construction, the maximum of lasting value is provided by your Cleaver-Brooks steam generator from the day it is installed.

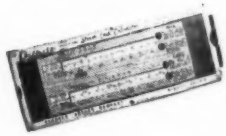
CLEAVER-BROOKS COMPANY
5109 N. 33rd Street, Milwaukee 9, Wis.

STUDYING THE STEAM LOADS OF YOUR PLANT





WRITE ON YOUR BUSINESS LETTERHEAD for the Free Steam Cost-Calculator — a ready-reference slide rule showing the comparative steam costs when using oil or coal as fuel.



WHY NOT HAVE A STEAM PLANT WITH ALL THESE ADVANTAGES?

Cleaver-Brooks
STEAM GENERATORS

- A steam plant tailored for your job. Cleaver-Brooks analyzes your load conditions, space and equipment arrangements, future growth needs, puts unit into initial operation, instructs as to operation, care maintenance.
- Designed for utmost convenience of operator—all controls may be operated from front of boiler. A factory engineer puts unit into initial operation, and trains your employees in operation, care and maintenance.
- One source and one responsibility for the complete generator—Cleaver-Brooks Factory-finished and tested—a fully "packaged" unit meeting all code requirements.
- Fast installation. No special foundation needed. Within 24 hours after arrival, your Cleaver-Brooks Steam Generator can be in operation.
- No smoke-stack required; simple roof-high vent exhausts combustion gases.
- Saves space, uses less plant area, fits into low head-room locations.
- Oil-firing eliminates smoke, ashes, clinkers, messy boiler-room conditions.
- Low operating costs; unsurpassed guarantee: — 80% thermal efficiency; 13% CO^2 gases; stack temperature not to exceed 125° F above saturated steam temperature.
- Quick steaming—for any emergency or fluctuating loads — through high heat transfer with Cleaver-Brooks 4-pass down-draft construction and integral oil-burner.
- Full size range is available—22 models in sizes from 15 to 500 hp., at steam pressures from 15 to 200 lbs. p.s.i. Write for bulletin and complete information.

We need four hands

TO POINT OUT THE MAJOR FEATURES OF THIS MOTOR

But *you* need only one head . . . and two minutes . . . to appreciate these design advantages of the *new* Crocker-Wheeler Protected-Type Motor.

1. Frame and shields have no openings above the horizontal center line, which means that dripping liquids, falling metal chips, etc., can't get inside the motor to damage the interior working parts.

2. *Vinylastic* insulation makes coils dirt, oil and moisture resistant to a high degree. Phase insulation provides added protection. Treatment in thermo-setting varnish lengthens insulation life and prevents destructive vibration of coils.

3. Bars, fans and end rings of *Alucast* rotor are die cast in one operation from aluminum alloys, forming a practically indestructible rotor. All rotors are dynamically balanced to assure smooth, vibrationless operation.

4. Patented bearing seal for ball bearings (sleeve bearings are optional) is so effective that regreasing is required only once a year or even less frequently, hence maintenance expense is negligible. This seal permits use of softer grease, for better lubrication and longer bearing life.

Write on your company letterhead for a FREE copy of descriptive bulletin DL-121, which tells where these motors should be used. Or if you prefer, one of our field engineers will be glad to help you decide whether this is the type of motor you need. Write today . . . no obligation.

THESE COUPLINGS HAVE UNIQUE FEATURES, TOO!

The Crocker-Wheeler resilient flexible coupling consists of a spider, a flange, a ball retaining cover and six synthetic rubber balls—that's all there is to it! And yet, this is more than just a trouble-free coupling—it actually adds years to the life of both the driving and driven machines.

The balls transmit torque, absorb shock and vibration, yet do not transmit end thrust. Available for shaft diameters up to 8", these couplings require no lubrication, no maintenance of any kind. Write for complete information.

CW-4

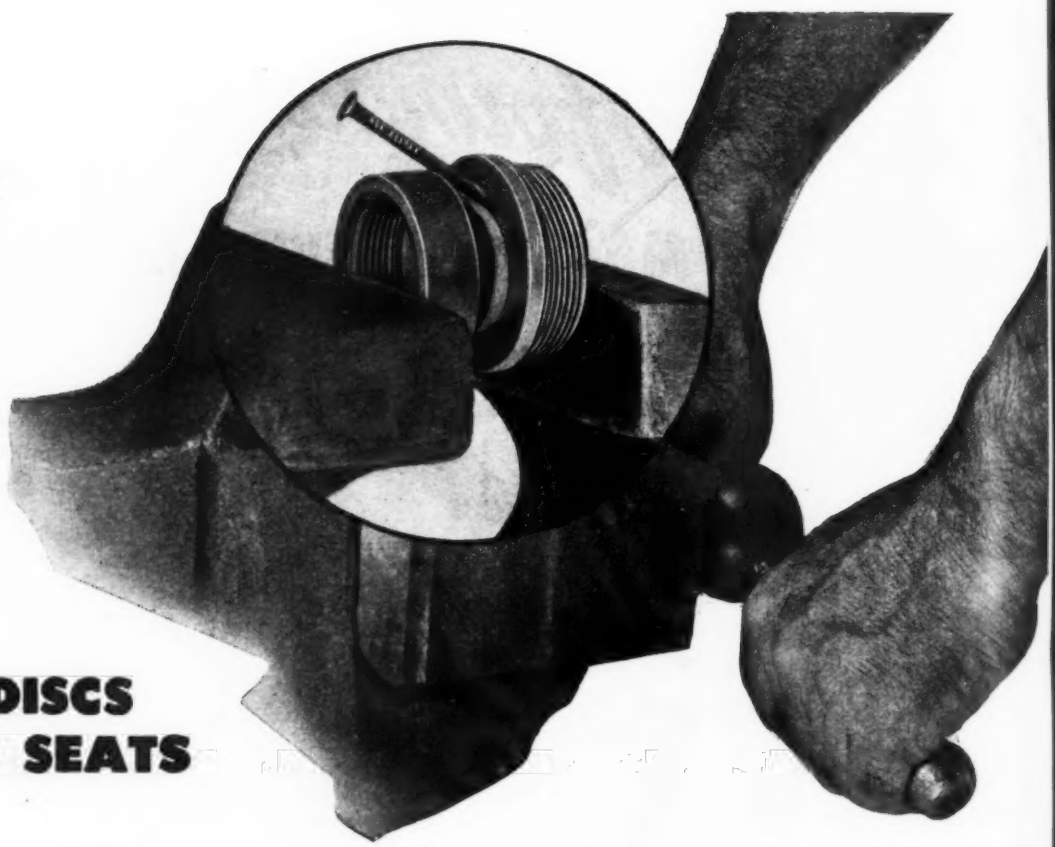
CROCKER-WHEELER

A DIVISION OF JOSHUA HENDY IRON WORKS, AMPERE 26, NEW JERSEY

Branch Offices: BOSTON • BUFFALO • CHICAGO • CINCINNATI • CLEVELAND • DETROIT • LOS ANGELES • NEW YORK • PHILADELPHIA • PITTSBURGH • SAN FRANCISCO • WASHINGTON

SQUIRREL CAGE MOTORS WOUND ROTOR MOTORS DIRECT CURRENT MOTORS GENERATORS FLEXIBLE COUPLINGS

Number 225P—Globe
Number 227P—Angle



WITH DISCS AND SEATS

Hard Enough to Crush Nails

. . . The WALWORTH No. 225P Bronze Valve cuts maintenance costs to the bone

THE Walworth No. 225P is the hardest . . . toughest Bronze Valve your money can buy. Its stainless steel seats and discs, heat treated to 500 Brinell (hard enough to crush nails) can be closed on boiler scale, sand, grit, and similar abrasive particles without marring the seating surfaces. "Wire drawing" is eliminated. Even after years of severe service it will assure tight, positive shut-off.

Further, every other part of Walworth No. 225P has been designed and constructed to afford full protection against wear and leakage. Available in both globe and angle types (angle type No. 227P) in sizes from ¼" to 2", this quality valve is recommended for superheated steam up to 500 F, and 1000 pounds non-shock service on cold oil, water, gas or air.

For complete data on this long-life, economical Walworth Bronze Valve see your nearby Walworth distributor, or write for Catalog No. 42. The catalog gives all information, including sizes, dimensions, specifications and list prices on this, as well as Walworth's complete line of valves and fittings.

Nail flattened without marring either the valve seat or disc.

14 AWARDS TO 4 PLANTS

WALWORTH

valves and fittings

60 EAST 42nd STREET, NEW YORK 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

keep a Steel Grip On Your Clamp Problems

PERFECT HOSE CLAMP
For all types of pressure suction hose. Flat steel band cannot cut hose cover.

PIPE REPAIR CLAMP
Repairs pipe or tank leaks for a few cents, in a few seconds. No need to tear down or disconnect equipment.

Permanent—Easy-to-Use Economical

You can cut your maintenance worries and costs with BAND-IT Clamps. Three simple items — BAND-IT Tool, Steel Band, and Buckles — enable you to form pressure clamps of unusual strength and holding power in any diameter from ½ inch to 30 feet. With BAND-IT, you can apply clamps around any object in any location—can quickly repair leaky pipes, or clamp hose lines right on the job without disconnecting.

BAND-IT

INDUSTRIAL PRESSURE CLAMPS OF ALL DIAMETERS FORMED FROM CONTINUOUS ROLL OF BAND-IT BAND

BAND-IT CLAMPS GO ROUND THE WORLD

Have you seen the new **BAND-IT CLAMP** *Warehouse?*

HOLDS 850 INDUSTRIAL PRESSURE CLAMPS ANY DIAMETER IN LESS THAN ONE CUBIC FOOT OF SPACE

WRITE FOR FREE CATALOG GIVING FULL DETAILS

BAND-IT COMPANY

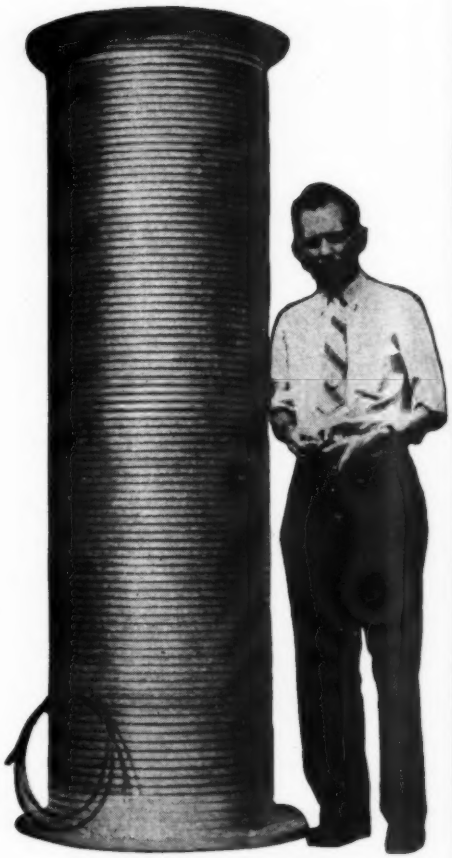
INCORPORATED

2536 WALNUT STREET DENVER 5 COLORADO U S A

PENFLEX

NOW 24" I.D. PENFLEXIBLE INTER-LOCKED GALVANIZED STEEL HOSE FOR STATIONARY and MARINE DIESEL EXHAUSTS

PENFLEX Interlocked construction resists pulsations of load and pressure, absorbs vibration, prevents metal fatigue. PENFLEX Interlocked construction provides the flexibility to make quick, easy installations. PENFLEX Interlocked construction with asbestos packing gives you a pressure-tight, trouble-free exhaust connection. PENFLEX 24" Interlocked, the largest hose in the PENFLEX line, has a bending radius of approximately seven times its diameter and a working pressure of 15 to 25 psi. PENFLEX Interlocked construction requires no special tools or heat to bend.



Complete range of sizes from 5/32" I.D. to 24" I.D.

PENFLEX
Hose and Tubing is also available for other flexible connections on Diesel Installations.

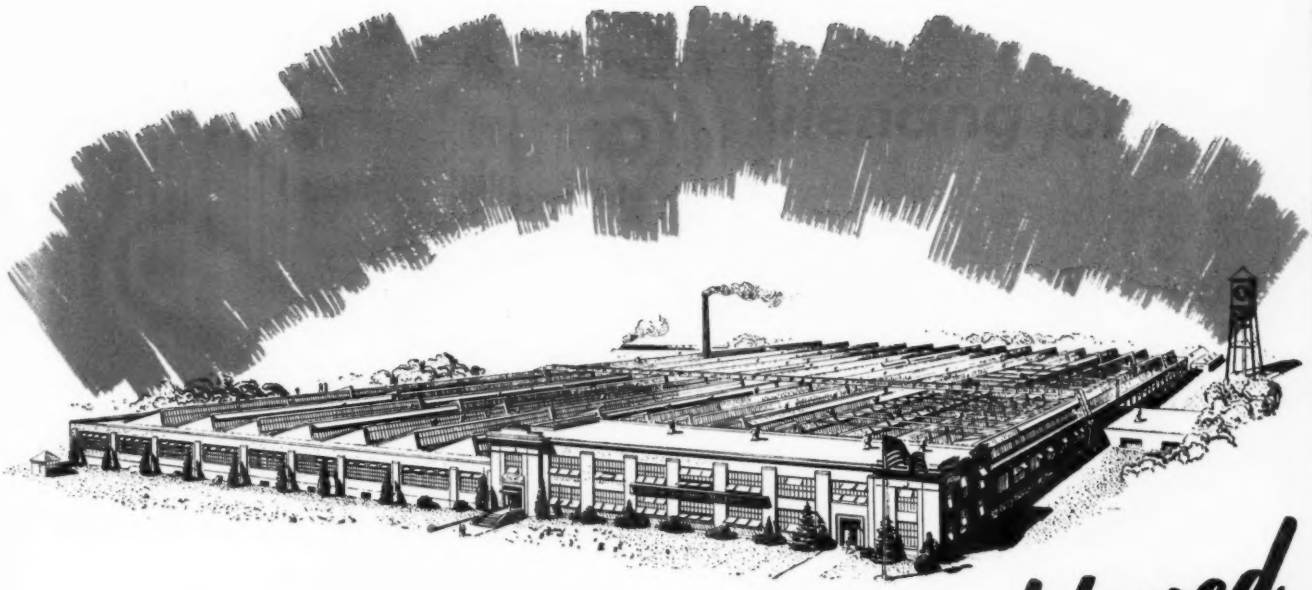
PENFLEXWELD
for Fuel Oil and Starting Air.

PENFLEX
Interlocked for Lubricating Oil, Circulating Water, Exhausts and Air Intake Lines. Write for Bulletin 71.

PENFLEX METAL HOSE

PENFLEX

PENNSYLVANIA FLEXIBLE METALLIC TUBING CO.
7238 POWERS LANE Established 1902 **PHILADELPHIA 42, PA.**



So, We'll BE Old-Fashioned

(IN OUR ADVERTISING)

Ad men tell us that plants haven't been shown in ads for 20 years. We're doing it anyway. Because the kind of plant we run has much to do with the kind of motors we make.

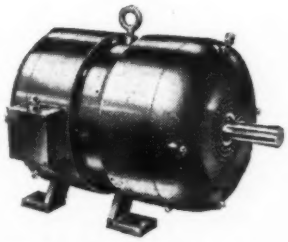
You see above what we call a BIG small plant, (290,000 sq. ft. and 1500 workers). Big enough to build a lot of motors of the kind Star builds. Small enough so we can keep a close eye on all the details that affect quality.

You see a plant that anybody would call modern. And, its equipment is as up-to-the-minute as the buildings, including fine research and testing facilities.

You Don't See the Important Part . . .

No picture can show you the kind of men who build Star Motors, or the way they work. But, come to visit us someday, and you'll see a plant full of real "motor men" . . . men who put the best of themselves, along with the best of materials into the motors they build. See us at our job and we won't need to sell you on making Star your *"Motor Department"*.

With a complete line of standard motors and design know-how that has licked "stumpers" in motor application for many important makers of power-driven products, Star is ready to work with you on any need. Early delivery of some standard motors can be made. For AC or DC motors ⅛ to 200 HP and AC or DC generators to 150 KW, write Star Electric Motor Company, 228 Bloomfield Avenue, Bloomfield, N. J.

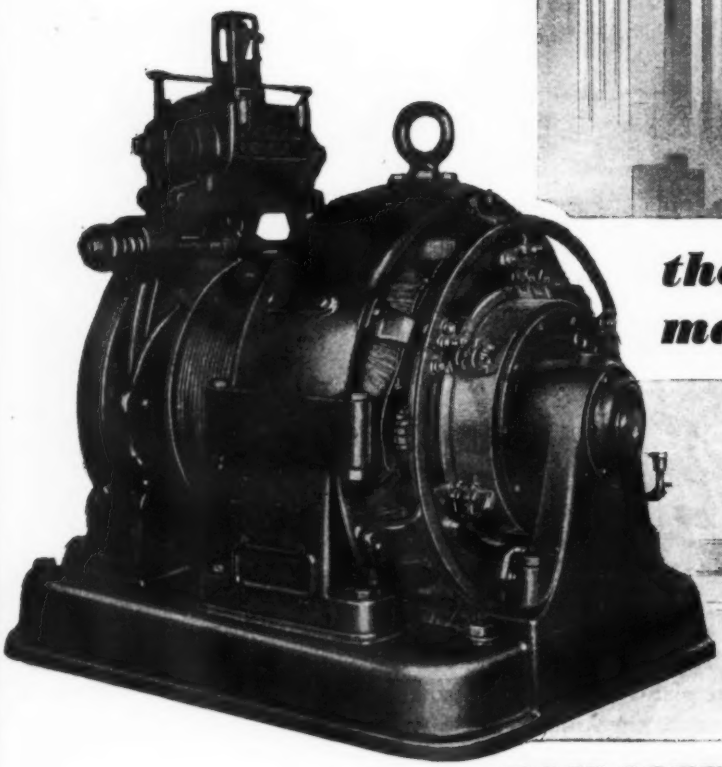


AC Fan Cooled Type in Star line of ⅛ to 200 HP motors.

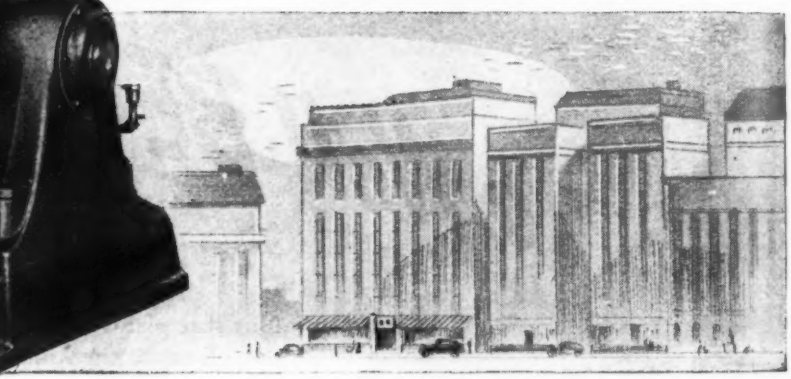
ARMY (E) NAVY

STAR MOTORS

POWER PACKAGED AS YOU NEED IT



the machine that helped make skylines . . .



now serves small buildings, too

The gearless elevator machine, first designed by Otis Elevator Company, was the result of a demand for faster and more efficient vertical transportation in tall buildings.

During the past 43 years, the smooth, quiet performance, and the economical operation of this machine have earned it universal recognition and acceptance. For these reasons, many Architects and Engineers today specify Otis Gearless Elevators *for smaller buildings* — whenever performance of outstanding quality is required.

Stores, Hospitals, Hotels, and many other buildings—whether of a few stories or many — can now benefit by the life-long operating smoothness and efficiency of Otis Gearless Elevators.

Otis representatives are ready now to cooperate with Architects and building owners . . . to recommend the equipment best suited to individual needs. For the finest in vertical transportation tomorrow, call your Otis representative TODAY.

Otis ELEVATOR COMPANY
OFFICES IN ALL PRINCIPAL CITIES

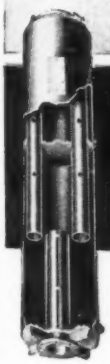
WHY DO YOU FIND MAXIMS on the really TOUGH silencing jobs?

The giant Maxims standing out against the skyline below quiet the exhaust of Diesels on test stands at a large industrial Diesel manufacturing plant. Time and again in important installations of this kind and in many smaller installations where the silencing problem is none the less critical, the most satisfactory answer has been found with Maxims.

The reason "why" is threefold and lies in *experience, performance* and *adaptability.*

- Maxim can show more years of research and experience in solving tough silencing problems.
- Maxim performance over the years is typified in thousands of successful working installations, large and small.
- Maxim adaptability means a line of silencers so varied that it is seldom necessary to go beyond the standard silencers to get a job "tailor-made" for your installation.

By the same token when special silencers *are* needed, Maxim engineers, constantly working on development and new design problems, are particularly capable of solving your special problems.

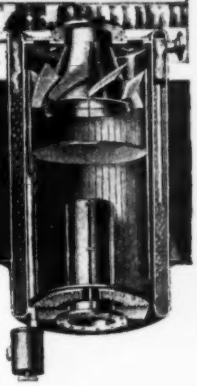


MAXIM EXHAUST & INTAKE SILENCERS

WRITE FOR BULLETINS
D 125
D 127
D 101
D 37

MAXIM HEAT RECOVERY SILENCERS

WRITE FOR BULLETINS
WH 100
WH 101
WH 103



These Maxim Silencers (model MUC illustrated) are designed to silence the exhaust or intake of internal combustion engines, steam engine exhaust, air compressor intake, vacuum pump discharge and the intake or discharge of blowers of the positive pressure type. Wide choice of models to fit varying space and silencing requirements. Spark arresting where necessary.

Maxim Heat Recovery Silencers combine efficient silencing of engine exhaust with spark arresting (where necessary) and with the efficient recovery of waste exhaust heat to produce steam or hot water for heating or processing operations. These Heat Recovery Silencers give highly efficient heat transfer . . . are available with automatic controls, and may be run wet or dry without injury to the unit.

THE MAXIM SILENCER CO. • **92 HOMESTEAD AVE., HARTFORD, CONN.**

ARMY E NAVY

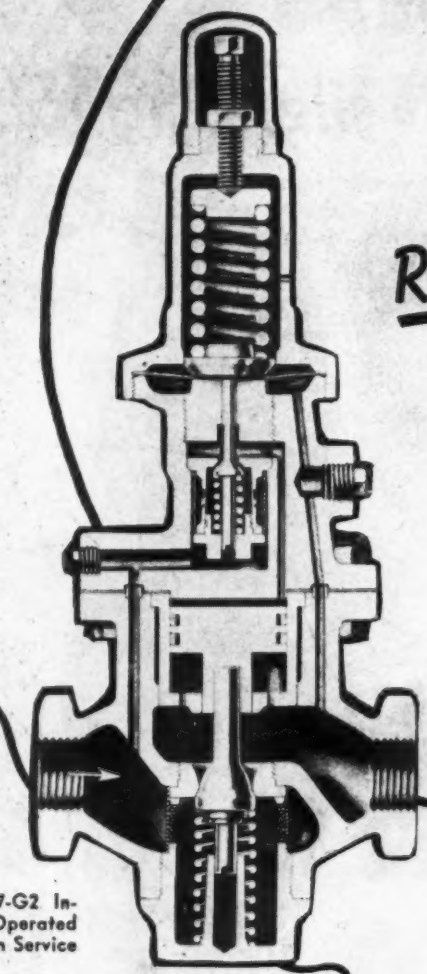
MAXIM

FOSTER

REGULATION ENGINEERING

Means

STRAIGHT LINE RECORDING



Foster Type 37-G2 Internally Pilot Operated Valve for Steam Service

- **CLOSE REGULATION** — In spite of wide variations in inlet pressure
- **COMPACTNESS** — It is self-contained
- **TIGHT SHUT-OFF** — For dead-end service. Metal-to-metal single seat construction protects low pressure header from build-up
- **LOW MAINTENANCE** — Designed for easy access for routine inspection and maintenance. Pilot assemblies interchangeable within three size groups. Protected by strainers

Illustrated catalog on the complete Foster line, with many pages of useful engineering data will be sent if requested on company letterhead. Ask for Catalog 70.

☆ **BUY WAR BONDS** ☆

FOSTER ENGINEERING Company

PRESSURE REGULATORS...RELIEF AND BACK PRESSURE VALVES...AUTOMATIC STOP AND CHECK VALVES...ALTITUDE VALVES...DAMPER REGULATORS...FAN ENGINE REGULATORS...PUMP GOVERNORS...TEMPERATURE REGULATORS...LIQUID-LEVEL CONTROLLERS...FLOAT AND LEVER BALANCED VALVES...NON-RETURN AND TRIPLE DUTY VALVES...VACUUM REGULATORS OR BREAKERS...SIGHT FLOW BOXES...STRAINERS...SAFETY VALVES...SIRENS

106 MONROE STREET • NEWARK 1, N. J.

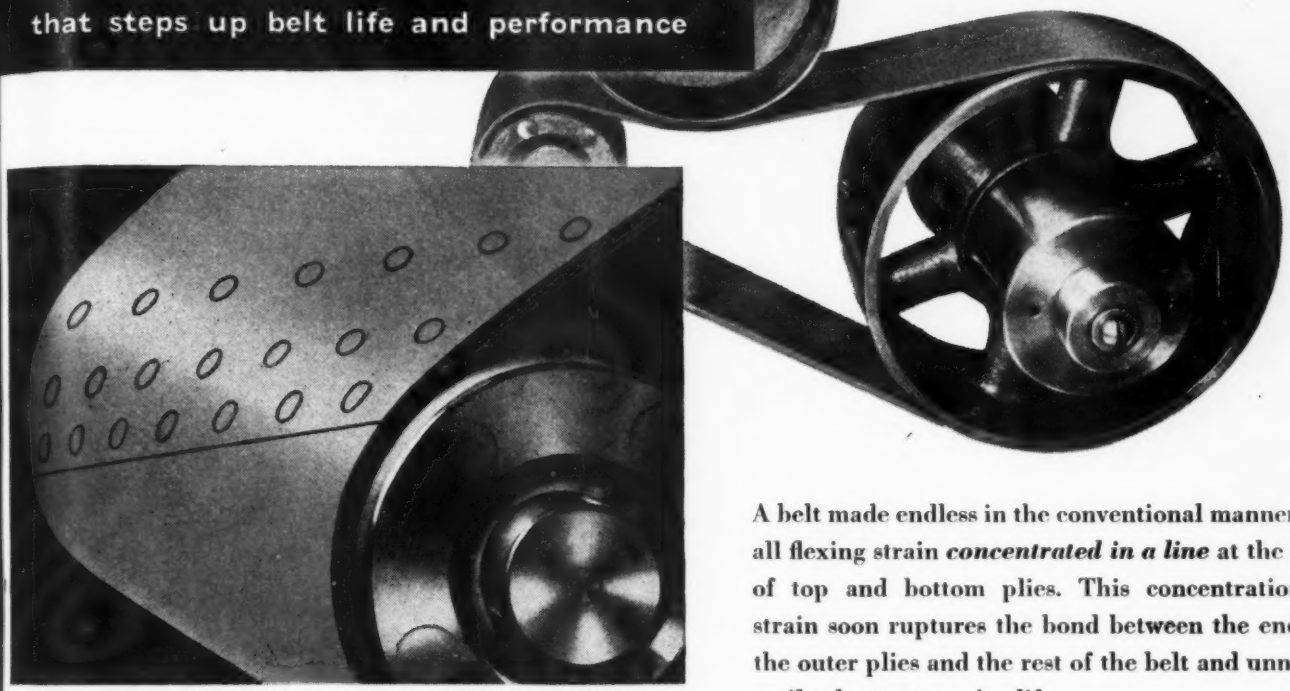
8-FE-1

Extensible-Tip in CONDOR ENDLESS BELTS

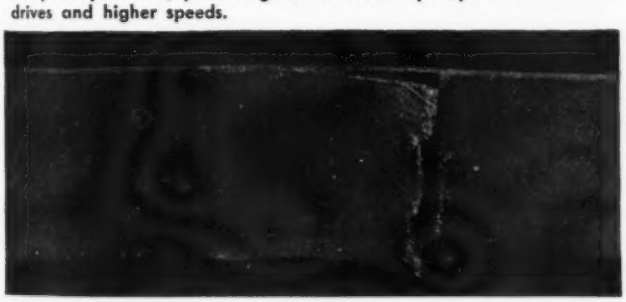
an important MANHATTAN development that steps up belt life and performance

ADVANTAGES

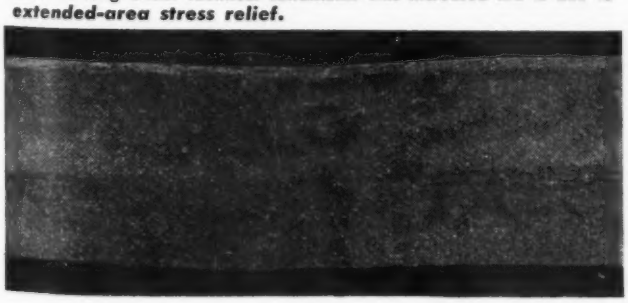
1. Increases flexibility at splice.
2. Can be operated over smaller pulleys.
3. Can be operated at higher speeds and heavier loads.
4. Prolongs splice life 3 to 10 times.
5. Reduces belt and maintenance costs.



All warp threads in outer plies are cut by suitably spaced perforations filled with "live" FLEXLASTICS, which are then vulcanized to become "elastic rivets." These stretch and relax progressively (see illustration) as they pass over the arc of contact, providing stress relief for every warp thread, permitting use of smaller pulleys on short-center drives and higher speeds.



Above: Ordinary type of splice which failed when ply end gave way.
Below: A splice with EXTENSIBLE-TIP, still unbroken after running 10 times as long under identical conditions. This increased life is due to ***extended-area stress relief.***



A belt made endless in the conventional manner has all flexing strain ***concentrated in a line*** at the ends of top and bottom plies. This concentration of strain soon ruptures the bond between the ends of the outer plies and the rest of the belt and unnecessarily shortens service life.

MANHATTAN'S EXTENSIBLE-TIP—an exclusive, patented Strength Member development—provides multiple stress relief, uniformly ***distributed over an area*** of the belt where the duck ends. In addition, the end is welded to the adjacent ply by "elastic rivets" made from special FLEXLASTICS.

It is this extended area of stress relief that makes the Extensible-Tip last as long as the belt, lets you run the belt at higher speeds, over smaller pulleys, on short-center drives, and increases its service life from three to ten times over ordinary methods of making the same belt endless.

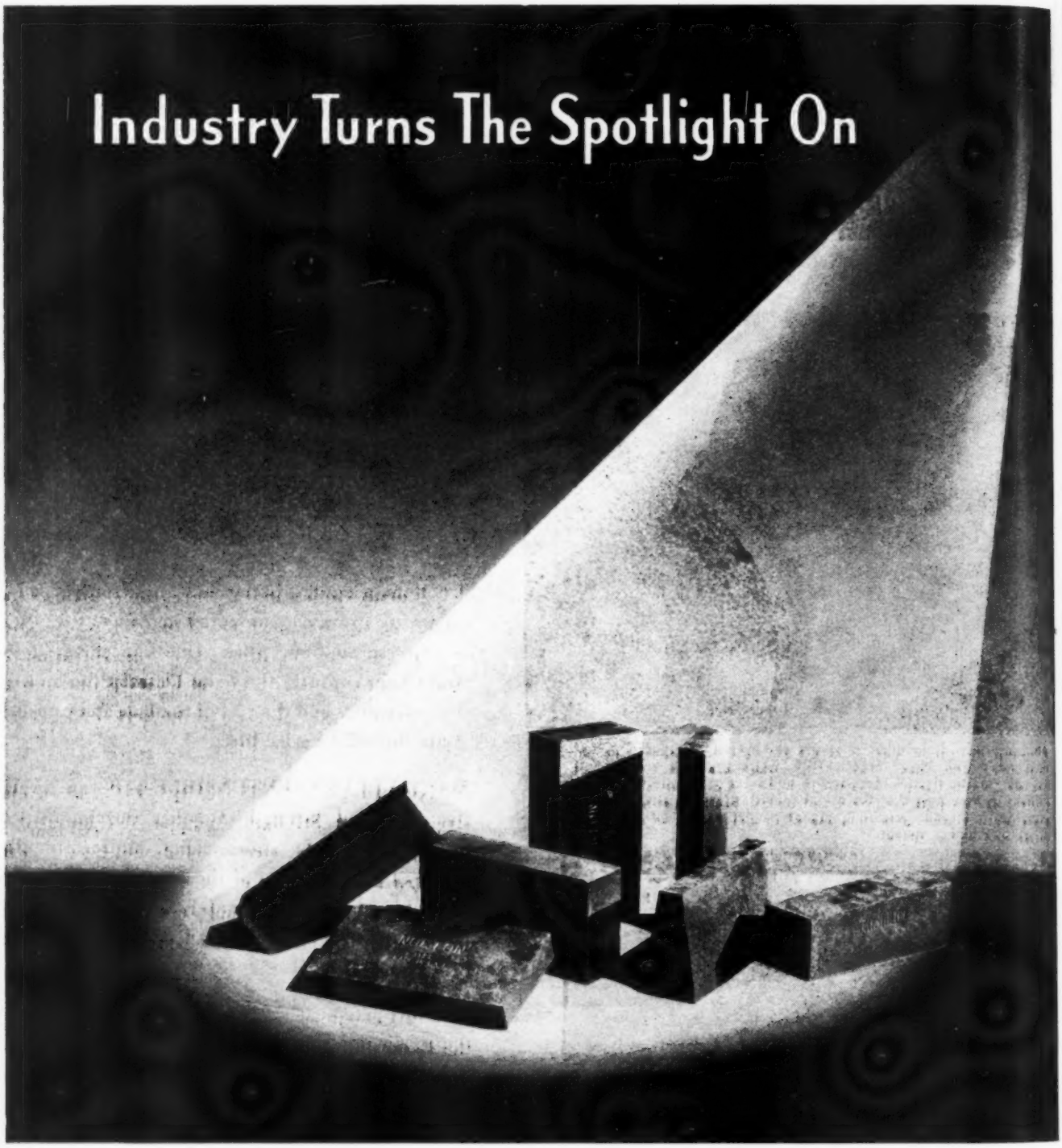
You protect the continuity of your production when you use MANHATTAN Endless Belts, all of which are made with the ***extended-area stress relief*** provided by the MANHATTAN EXTENSIBLE-TIP.

The term FLEXLASTICS is an exclusive MANHATTAN trade mark. Only MANHATTAN can make FLEXLASTICS. Condor Belts are now made in the dark, war-time color.

THE MANHATTAN RUBBER MFG. DIVISION

OF RAYBESTOS-MANHATTAN, INC.

EXECUTIVE OFFICES AND FACTORIES PASSAIC, NEW JERSEY

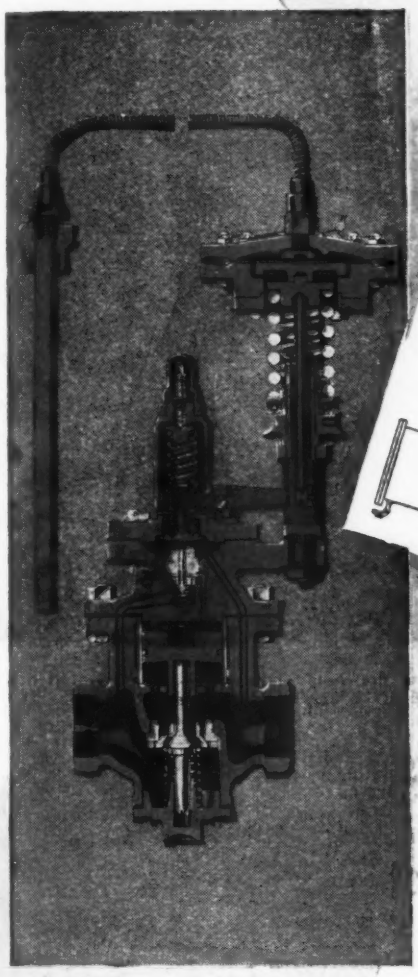


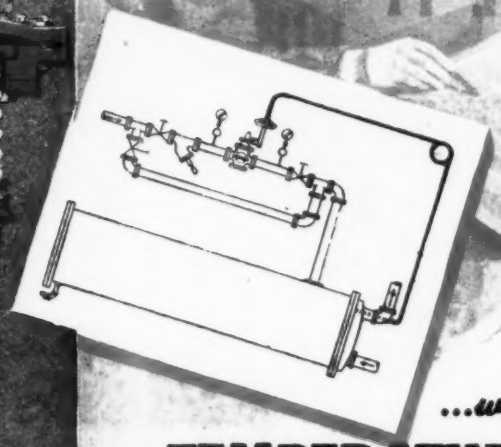
CRYSTOLON BRICK

Wartime peak operation emphasizes CRYSTOLON Brick's outstanding quality — long, trouble-free service . . . . a serviceablity derived from these characteristics: (1) great refractoriness, (2) chemical stability, (3) resistance to abrasion, (4) resistance to the corrosive action of ash and the penetration of slag.

NORTON COMPANY - - - Worcester 6, Mass.

"We can simplify our piping...cut installation costs—and CONTROL BOTH Temperature and Pressure"...





...with the LESLIE TRADE MARK REG. U. S. PAT. OFF.

TEMPERATURE REGULATOR

SELF-CONTAINED

Anywhere in your plant—wherever you want to guard your least or your most important processes with BOTH accurate temperature regulation and pressure control, simultaneously—you can easily and quickly install the Leslie Temperature Regulator with the assurance of absolute dependability of results.

• *EXTREME ACCURACY AND SENSITIVITY*

This Regulator was designed for accurate, dependable control where other regulators failed. In brief, it holds temperatures *constant*, in the closest limits, with the *minimum* expenditure of steam.

• *MAY WE HELP YOU?* Leslie Engineers are prepared to work with you to help you select the correct type of Leslie product for your needs and to advise you regarding the most effective methods of installation. When writing please give *complete details* as requested in our bulletins.

features...

DUO-MATIC CONTROL—Temperature Regulation and Pressure Reduction with a SINGLE regulator.

WIDE RANGE, RUGGED THERMOSTATIC ELEMENT—100°F adjustable temperature.

SINGLE SEATED for positive dead-end control.

METAL DIAPHRAGMS—No bellows or packing glands

RENEWABLE WEARING PARTS—100% interchangeability

CORROSION & WEAR RESISTANT—Stainless Steel Hardened Wearing Parts.

FOR COMPLETE DETAILS

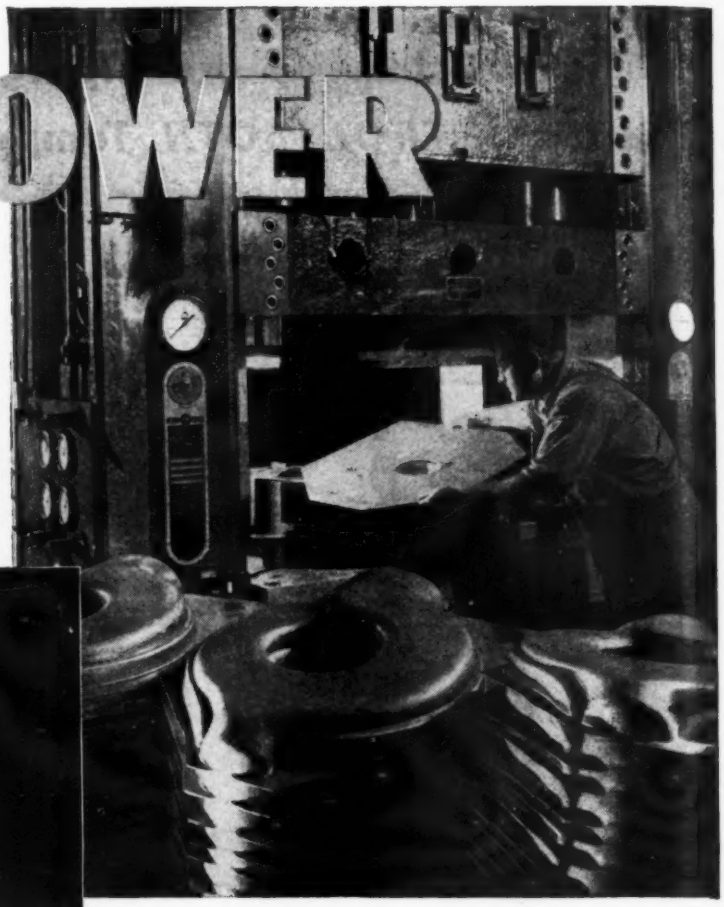
WRITE FOR BULLETIN 404A

LESLIE CO. • LYNDHURST • NEW JERSEY

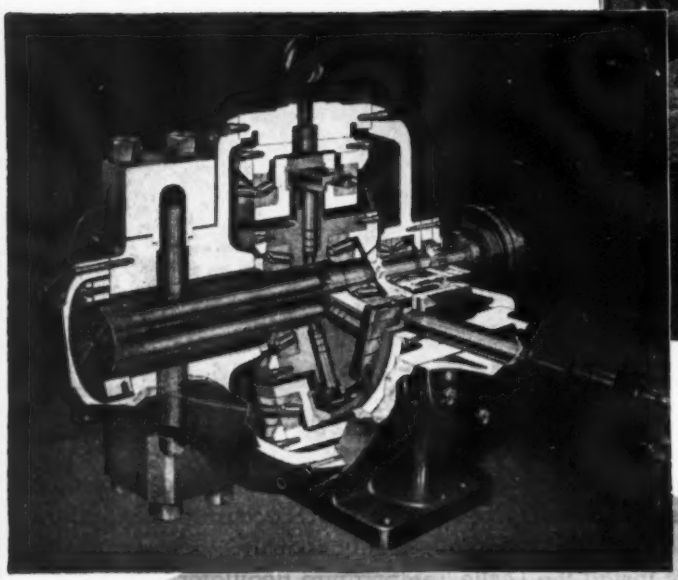
this takes **POWER**

AND

TIMKEN BEARINGS HELP PRODUCE IT



Forming intricate draws in stainless steel with an H-P-M FASTRAVERSE Press manufactured by The Hydraulic Press Mfg. Co., Mount Gilead, Ohio.



H-P-M Hydro-Power Radial Pump sectioned to show operating parts and locations of Timken Bearings.

The secret of the tremendous power and close controllability of H-P-M Presses is in the H-P-M Hydro-Power Radial Pump.

This pump combines high volumetric efficiency with dependable and consistently uniform performance, due to its design and fine precision construction.

Tolerances of operating parts are measured in tenths of thousandths and these clearances are maintained for high hydraulic efficiency.

The stationary valve pintle and the high-speed cylinder rotor in particular must be held within extremely close relationship with a minute operating clearance between them. This is done by mounting these parts on Timken Tapered Roller Bearings as shown in the sectional illustration.

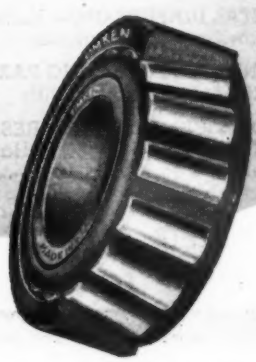
Furthermore, any slight bearing wear that might occur after long periods of service can be taken up with split-hair accuracy through a simple external adjustment made possible by the design of the Timken Bearing.

To be sure of getting genuine Timken Bearing performance, see that the trade-mark "TIMKEN" appears on every bearing you use. The Timken Roller Bearing Company, Canton 6, Ohio.

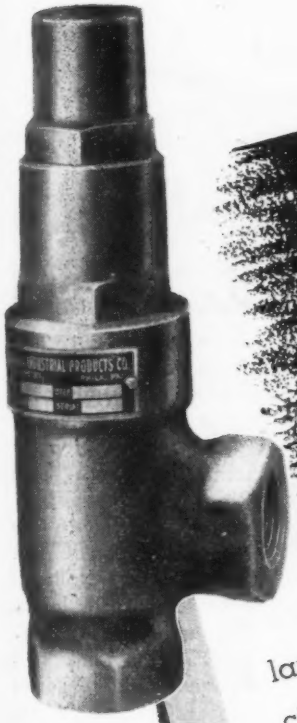
TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS



...when you have unusual control problems you want DEPENDABLE valves that are RIGHT for the job!

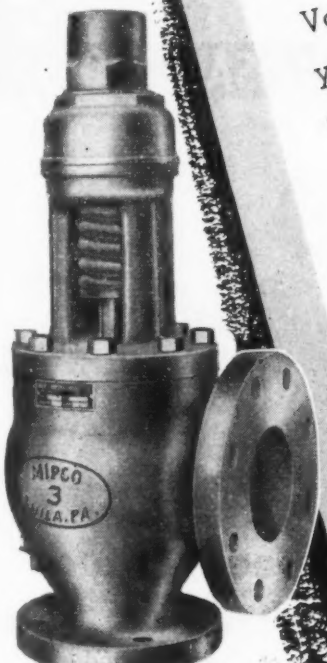


MIPCO RELIEF VALVE Class L Series 50; forged steel, threaded ends; ½" to 1½" sizes.

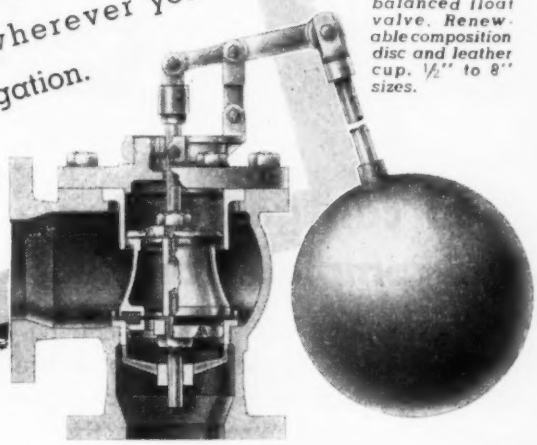
MIPCO RELIEF VALVE Class L Series 1; all bronze, threaded ends; ¼" to 2" sizes.

Associated Valves are not just "valves". They are particular, special valves for particular, special service conditions — that's the way they are designed and manufactured. When the right Associated Valve is selected for the application, you have the answer to reliable control and long, trouble-free service. The broad line of Associated products includes controls to fit most all ordinary and many special requirements. Associated control engineering experience is available to help you whenever and wherever you want it—without obligation.

Write, tell us your control problems.



MIPCO RELIEF VALVE Class L Series 120; cast steel, iron or bronze, 1" to 6" sizes.



SCHADE NO. 7 Single seated, balanced float valve. Renewable composition disc and leather cup. ½" to 8" sizes.

Above controls are products of

SCHADE VALVE MANUFACTURING CO. 2527 No. Bodine St. Philadelphia 33, Pa.

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The Genuine for accessibility

Removal of two bolts frees the top cap—and the valve and seat are completely exposed to view.

Squires

The accessible Squires has become a byword among power plant operators.

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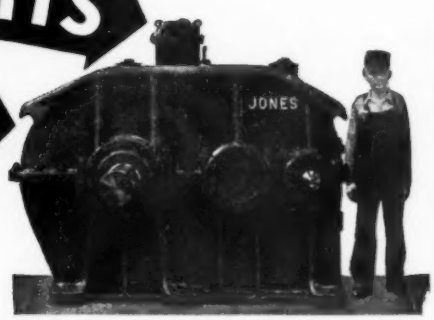
Whether you need THIS —or THIS



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YOU will find this 128-page catalog of Jones Herringbone Speed Reducers helpful in the selection of reducers in accordance with A.G.M.A. recommended practice for all conditions of service. Jones Herringbone Speed Reducers are built in single, double and triple reduction types and in every standard ratio in ratings ranging from 1.25 H.P. to 440 H.P.

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CUT AND MOLDED TOOTH GEARS • V-BELT SHEAVES • ANTI-FRICTION
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Maintain Pressure Regardless of Varying Flow Requirements!

Specify the

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Steam Pressure Reducing Valve!

This is the valve you need to sensitively maintain downstream pressure under varying flow requirements. Features that make this possible include balanced pilot valve operation and a single seated main valve to prevent downstream pressure from building up under "no service" operation.

Heavy duty construction eliminates any possibility of distortion from pipe line strain. This type unit is regularly supplied in Base Types or Globe Type Pilot Control. The Globe design permits mounting away from main valve. Valve trim may be Bronze, Monel, Stainless Steel or Gallavoy, according to individual plant requirements. Seat ring and disc may be Stellited. Ten sizes are available, from 2″ to 14″, to handle working pressures from 250 to 600 lbs.

Write for your copy of our latest catalog. It contains complete information on all G-A Specialty Valves, including detailed construction and operation data.

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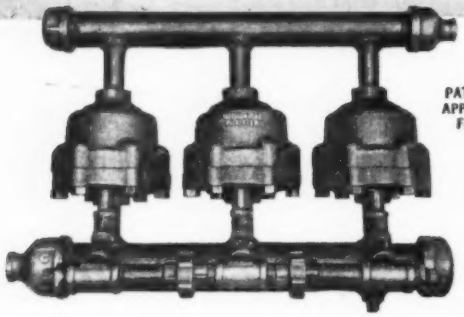
Manufacturers of Special Valves for Every Need

Fulton Building **Pittsburgh, Penna.**

Purify Any Pressures, Air or Gas, with Bird-White Multiple Unit *Pur-O-fier*



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Three Models Available

Model A-1 furnished with a 1 inch turbo-rotor and will accommodate volumes from 1 to 8 cubic feet.

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Bird-White multiple unit Pur-O-fiers save time and money by protecting air-operated machines, gauges and controls from contamination. They give positive purification to air or gas lines regardless of fluctuating pressures or high volumes.

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Please send me complete INSTANT-USE information and details of FREE TRIAL OFFER—no obligation.

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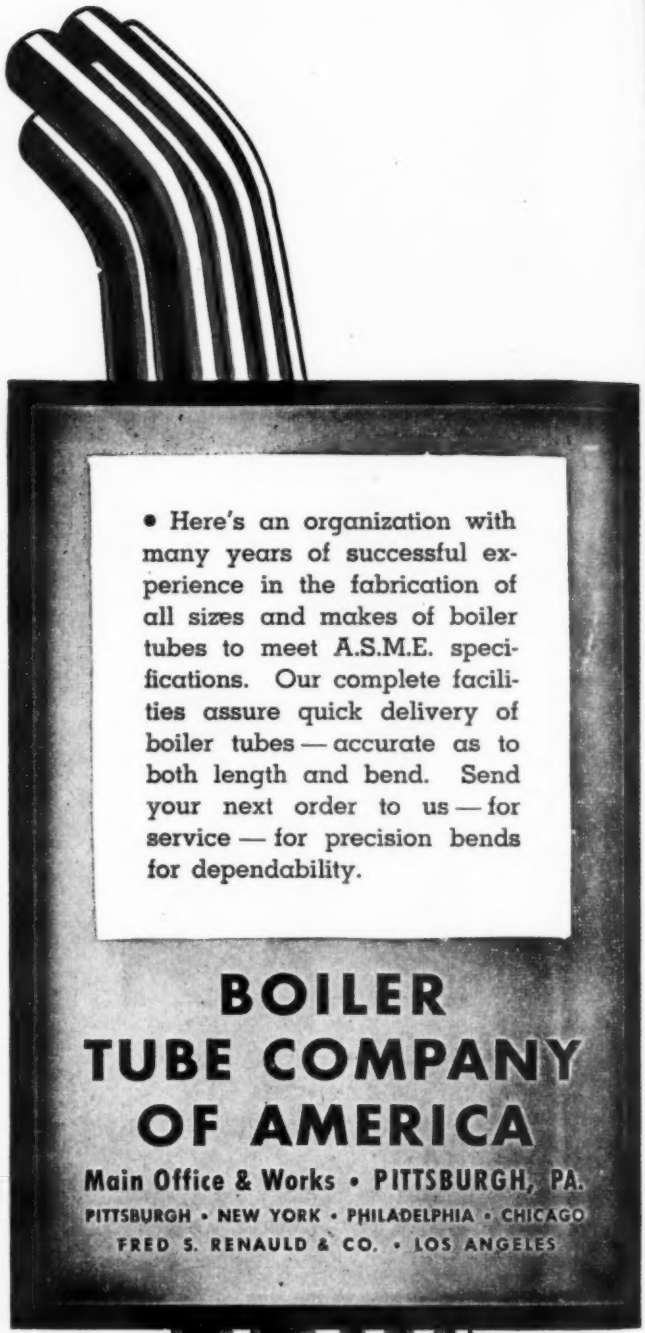

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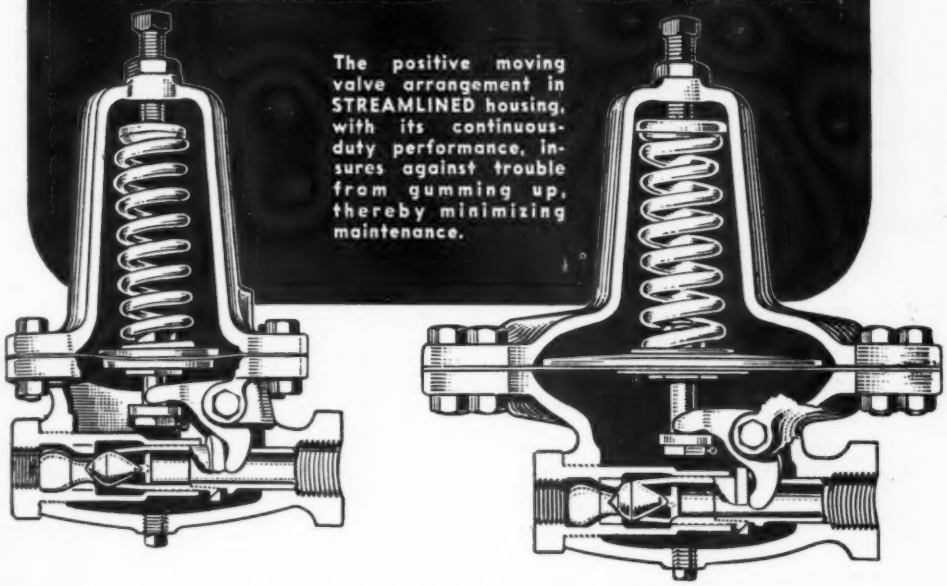
CASH STANDARD *Streamlined* TYPE 1000 PRESSURE REDUCING VALVES



The positive moving valve arrangement in STREAMLINED housing, with its continuous-duty performance, insures against trouble from gumming up, thereby minimizing maintenance.

THIS STRAIGHT LINE FLOW an Important Aid to CONTINUOUS PROCESSING

Write today for Bulletin 1000—it describes and pictures how, from inlet to outlet the fluid flows through this valve in a straight line—a streamline. Steam, air, and water capacity charts are shown. Eight pages of valuable valve facts.

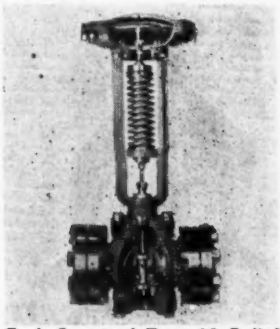
WHETHER your type of processing is continuous or batchwise, the "1000" Streamlined CASH STANDARD pressure reducing valve will contribute effectively to greatest overall efficiency. This is so because the Straight Line Flow insures —(1) maximum capacity—(2) close delivery pressure control—(3) accurate regulation—(4) tight closure. All of this results in smooth operation and continuous performance with practically no maintenance over periods that extend into years.

This accurate, reliable pressure reduction service for steam, air, oil — in fact for most anything that flows — is well worth your investigation so that you will know just how effectively and extensively the "1000" will benefit your entire process.

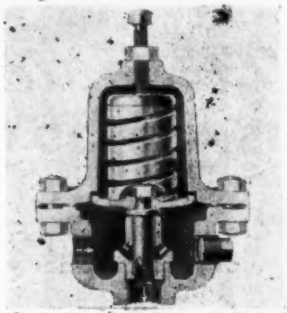
CASH STANDARD CONTROLS.. VALVES

A. W. CASH COMPANY
DECATUR, ILLINOIS

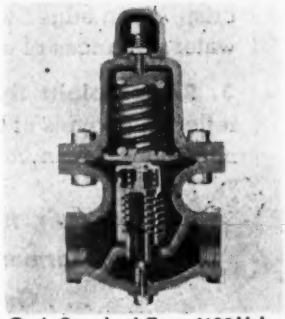
OTHER VALVES *from the* CASH STANDARD LINE



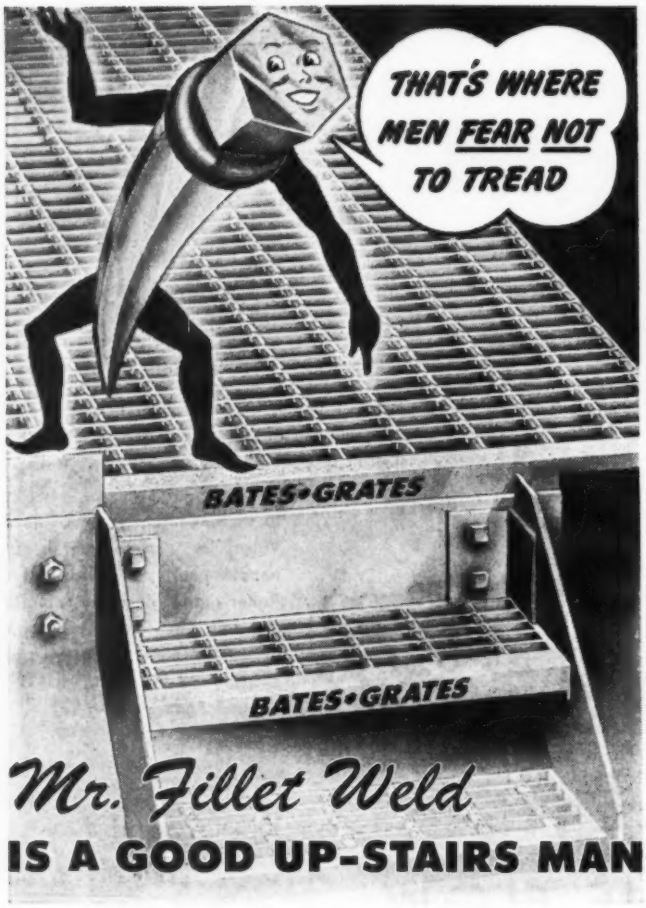
Cash Standard Type 33 Relief Valve; in various metals to handle nearly all fluids. Has Roller guides on valve spindle; also roller bearing to take care of spring torsion. Sizes ½" to 3" screwed ends; 1" to 12" flanged ends. Bulletin 971.



Cash Standard Type Q Relief Valve has side inlet, bottom outlet. Popular for pump by-pass use. Sizes ½" to 2" screwed ends. Relief pressures up to 350 lbs., temperatures up to 500°F. Bulletin 943.



Cash Standard Type 4190 Valve for relief (bypass) use; holds constant valve inlet pressure regardless of changes in load or outlet pressure. Multiport—large capacity. Iron or bronze bodies; iron or bronze trim. Sizes ½" to 2" screwed ends; 2" to 6" flanged ends. Bulletin 952.



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for stair treads, open steel flooring, floor armor and bridge decking . . .

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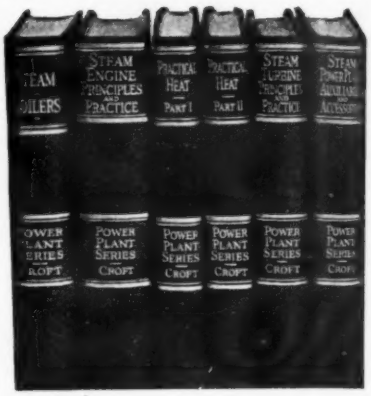
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- Guards Against Water Waste
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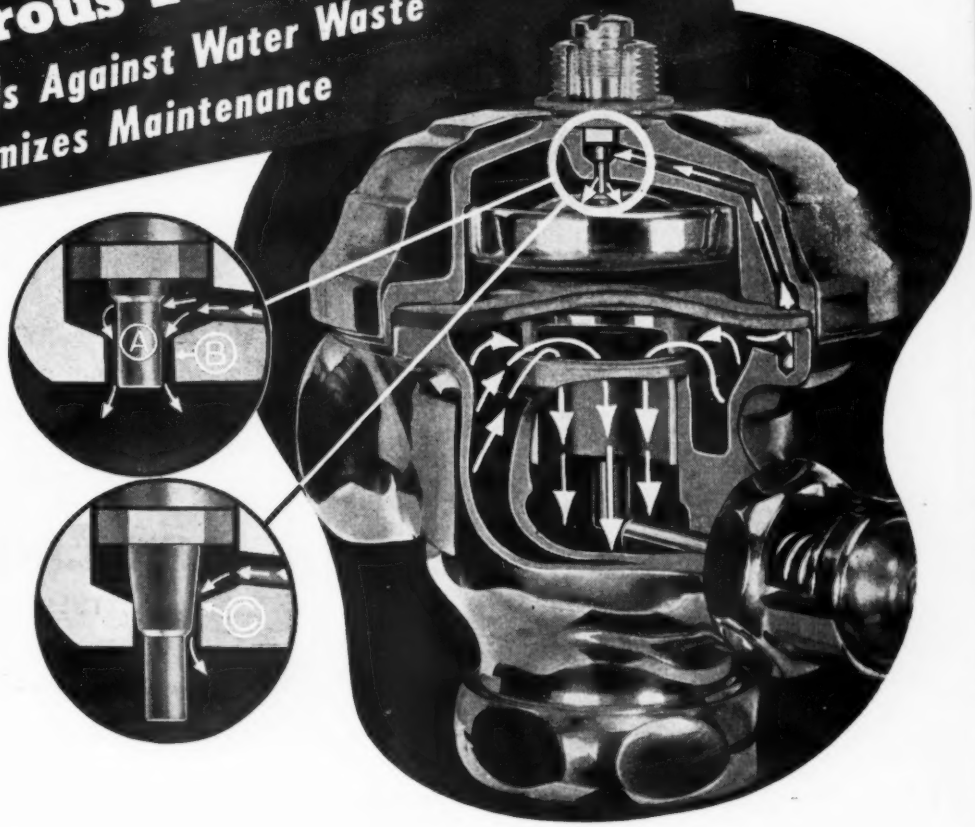

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- Screenless Silent-Action
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• The by-pass is the control-center of a flush valve. A small stream of water flowing through this by-pass governs the duration of the flushing period.

Watrous Flush Valves, in both diaphragm and piston types, have an automatic, mechanical device which cleanses the by-pass before each flush. This is a time-proven feature that *safeguards against prolonged flushing due to foreign matter in the water.*

When you specify Watrous Majestic or Imperial Flush Valves, you get this important safeguard on every fixture—a safeguard that adds greatly to the economy and dependability of flush valve operation.

Before you select flush valves for replacement, or for new installations, check up on the many Watrous points of superiority.

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How the Watrous Self-Cleansing By-Pass Works

At the start of each flush, plunger (A) is mechanically lifted from its position in the by-pass orifice (B). This greatly enlarges the orifice, momentarily allowing a very large amount of water to flow through it. This effectively washes away any ordinary dirt or sediment which may have become lodged there.

The plunger then drops down again in the orifice, which now has been thoroughly cleansed, and establishes the normal by-pass opening (C). This assures the proper length of flush.

For complete information on Watrous Flush Valves write for Catalog No. 448-A. Also ask for Bulletin No. 477 giving a summary of "Architects' Views on Flush Valve Applications".

• The exclusive Watrous self-cleansing by-pass is one of the many reasons why the selection of Watrous Flush Valves is a source of constant satisfaction over the years to everyone concerned.

THEY PAY FOR THEMSELVES IN THE WATER THEY SAVE

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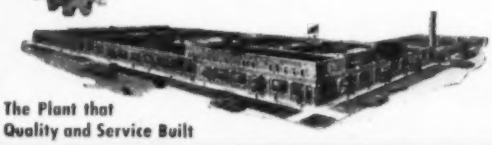
You'll find "Industrial Gear" a mighty fine organization to deal with. Write for our 272 page Catalog and Engineering Handbook on your Company stationery.



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JOHN ZINK BURNERS

JOHN ZINK
Series Y
COMBINATION BURNER

Left: John Zink Improved Series "Y" Register Type Combination Burner in Multi-way frame, with removable feather-weight oil and gas guns.

The Series "Y" is an ideal burner for heating and power installations where conservation of fuel is necessary.

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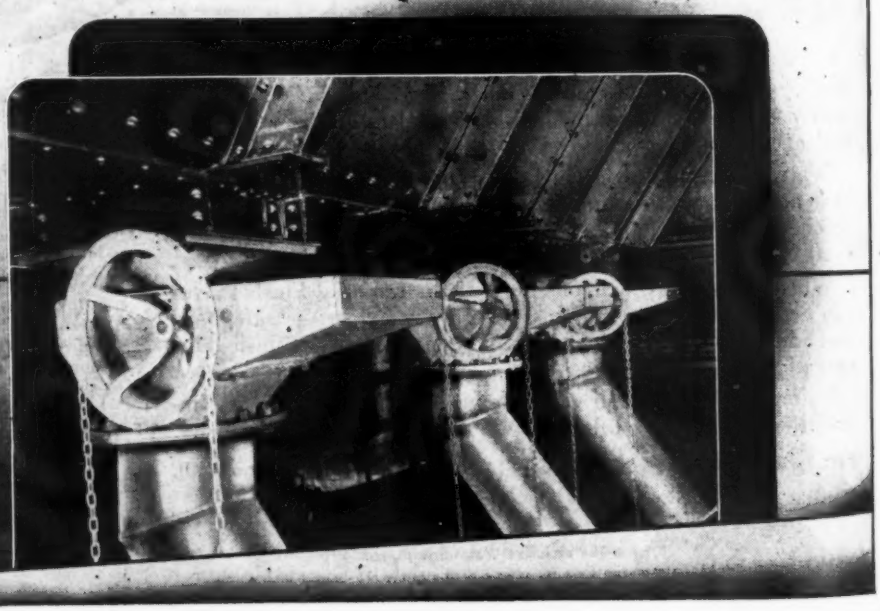
Brother, Here is a Coal Valve that won't stick!



Coal and water can't contact the racks and supporting rollers in the S. E. Coal Valve. It's the U-shaped Gate incorporated in the valve design that eliminates this . . . and because of this there can be no corrosion of parts or sticking caused by accumulations of coal dust in working parts. S. E. Co. Coal Valves open all the way and shut tight at all times. Catalogs and data sheets will be sent on request. Write Stock Engineering Co., 715 Hanna Bldg., Cleveland 15, Ohio.

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S.E.Co. Coal Valves and Coal Scales, CONICAL Non-Segregating Coal Distributors

Inside an engine, Pedrick rings pay-off through balanced oil control

AN ENGINE NEEDS OIL to lubricate the cylinder walls. If rings are too tight, serious wear results, shortening engine life. On the other hand, nobody wants an "oil hog." When rings are too loose, carbon troubles develop, fuel costs rise.

Pedrick rings are made to give balanced oil control through an exclusive process called Heat-Shaping. Developed by Pedrick engineers, this process sets exactly the right amount of tension around the entire circumference of the ring. Cylinder walls are properly lubricated. Engine block life is extended. Fuel costs are kept down.

One sure way to squeeze a little more life out of aging Diesels, to reduce down-time substantially, and to get greater fuel economy, is to recondition with Pedrick piston rings.

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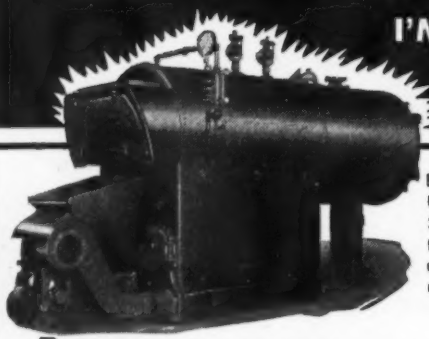
Pedrick

precisioneered PISTON RINGS

WAR BONDS ARE THE MONEY YOU HAVE IN YOUR WALLET . . . PLUS INTEREST

"SLOW DOWN! I'M GETTING FED UP!"



Brownell Matched Unit Boiler and Stoker built to work together. One manufacturer; undivided responsibility.

THE BROWNELL STOKER senses the Brownell boiler's need for less coal . . . or for *more*, as the case may be. Brownell *intermittent control* regulates the rate of coal feed in ratio to the steam load.

For instance, when the steam requirement is at the minimum, the Brownell Stoker feeds only enough coal to keep the fire going. Excess coal doesn't accumulate in the firebox to smolder and smoke.

Intermittent coal feed control is an exclusive Brownell Stoker feature. Ask for literature and name of nearest agent.

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ENGINEERS
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FACTORIES
RAILROADS
SHIP LINES

show impressively better performance almost immediately with

No-Karb Soot Remover (for coal or oil, high or low pressure boilers)

NCC Sludge Solvent (for oil-fired, high or low pressure boilers)

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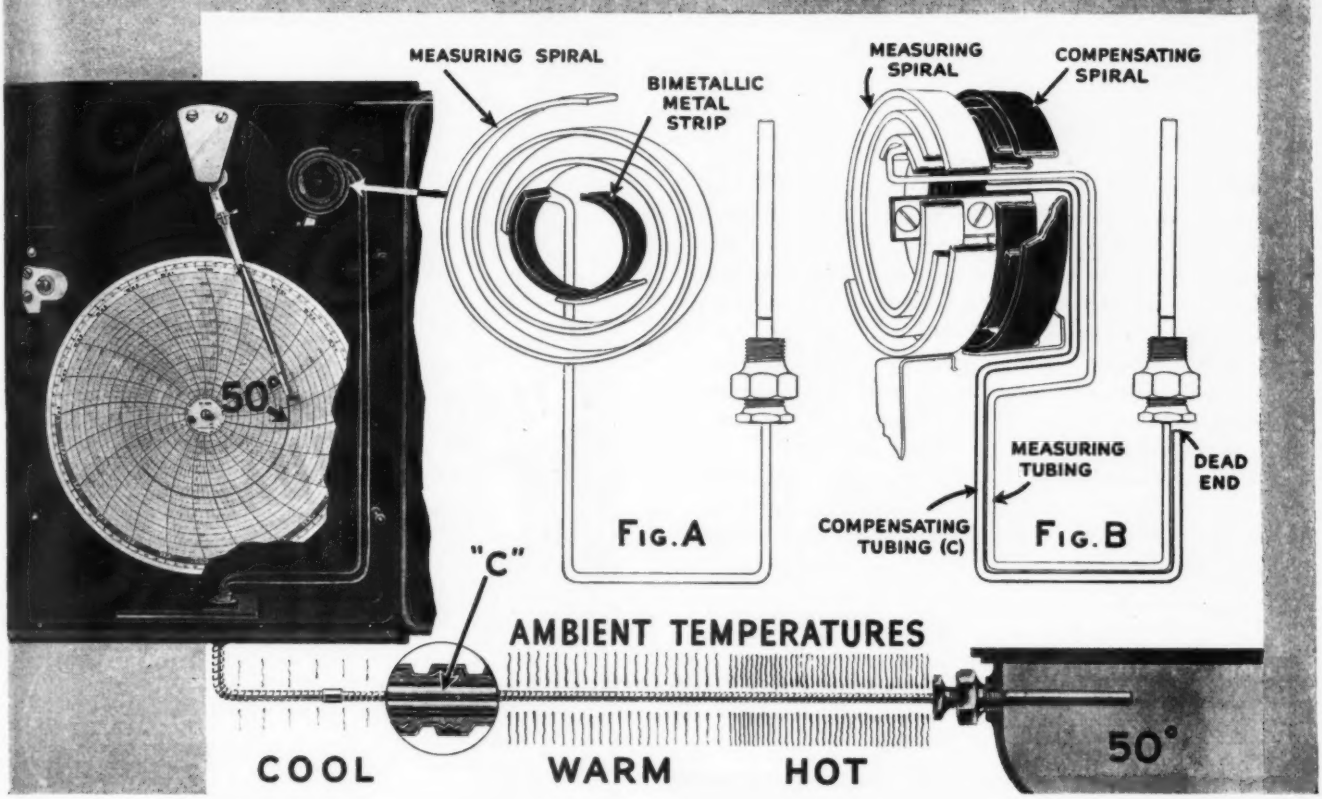
J&L TUBULAR PRODUCTS

Welded and Seamless Standard Pipe
Seamless Steel Boiler Tubes
Large O. D. Pipe, Welded and Seamless
Electricweld Mechanical and Pressure Tubes

Compensated for AMBIENT TEMPERATURES



PRECISION Recording or Indicating of true bulb temperature is a built in feature of Brown Thermometers.

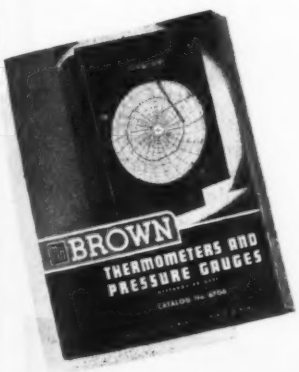
Errors due to ambient temperatures surrounding instrument case and capillary system are compensated for at the point of fluctuation.

Brown *Mercury* filled Thermometers (Fig. B) have two spiral actuating elements and two capillary tubes. The *first,* or measuring spiral is connected to the bulb through its capillary in the usual manner. The *second,* or compensating spiral, is connected to its capillary which is dead ended at the bulb.

The two spirals expand in opposite directions and are connected directly to the pen shaft. Therefore, a change in temperature within the instrument case itself or at points along the capillary tubing will affect both actuating spirals to the same degree and the results will exactly neutralize each other. Thus, errors are eliminated.

Ambient temperatures have a negligible effect on Brown *Gas filled* Thermometers. Case compensation all that is required for precision measurement is accomplished by a bimetallic strip shown in (Fig. A).

When you install Brown Thermometers you can rely on their precision—be confident of their dependability.

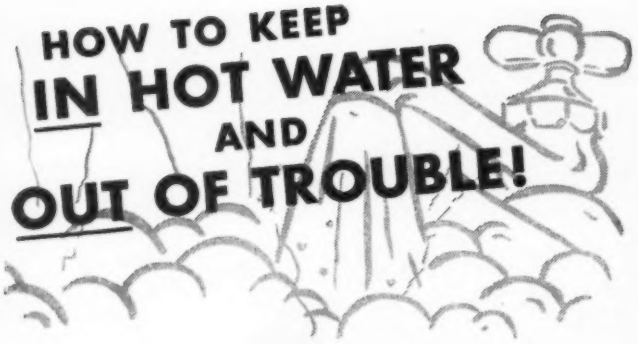


Other features are fully described in Catalog 6706

Write for a copy, THE BROWN INSTRUMENT COMPANY, a division of Minneapolis-Honeywell Regulator Company, 4490 Wayne Avenue, Philadelphia 44, Pa. Offices in all principal cities. Toronto, Canada: London, England: Stockholm, Sweden.

MH BROWN THERMOMETERS
INDICATING....RECORDING....CONTROLLING

HOW TO KEEP IN HOT WATER AND OUT OF TROUBLE!



● Where it's essential to keep a steady supply of hot water, install the MARION GULF STREAM HOT WATER HEATER. Indispensable to hotels, office and apartment buildings, large institutions, and factories of all kinds where abundant hot water is essential and steam is available.

Construction is simple. Water is heated faster through intimate contact with steam chambers adjoining. Internal parts float independently, avoiding strain from rapid contraction and expansion.

Low pressure steam is utilized with greatest economy. Inexpensive investment. Capacities range from 370 to 3700 GPH. Instantaneous type but can be used with storage tank.

Write Us Your Requirements and Let Us Solve Your Hot Water Problem!

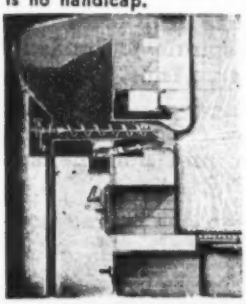
THE MARION LINE

MARION MACHINE, FOUNDRY & SUPPLY CO.
Marion, Indiana, U.S.A.

FYR-FEEDER MULTIPLE SPREADER STOKERS

BURN COAL LIKE OIL!

Save with Fyr-Feeder—Burn less Coal—Cheaper coal—Local coals—Screenings—Coal yard sweepings, wet or dry—Wet coal is no handicap.



FYR-FEEDER

exclusively uses

Air JET Coal PROPULSION

Fines burn in suspension, larger pieces are spread evenly over grates.

Fyr-Feeder increases boiler capacity—responds instantly to sudden load variations—requires no special skill or experience to operate—thin fuel bed eliminates clinkers—makes firemen's work much easier—no banking losses.

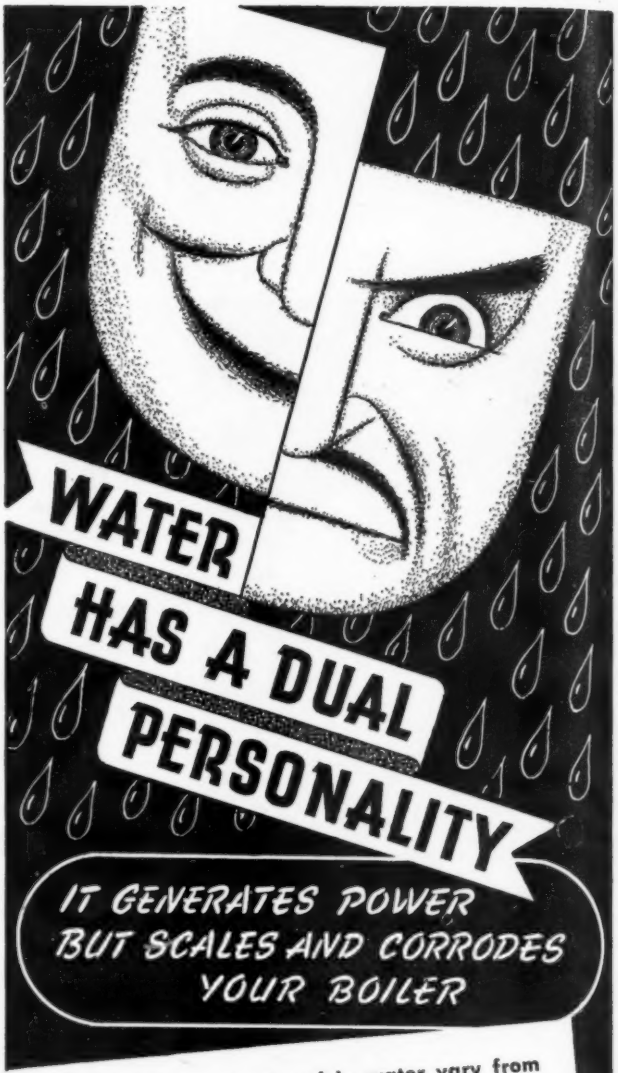
CHANGE OVER TO FYR-FEEDER NOW!

Easily installed in minimum time.

Fyr-Feeders are built in sizes to burn from 300 to 12000 lbs. of coal per hour. If you are or expect to be in the market for automatic coal burning equipment

Wire or Write
FYR-FEEDER Stoker Division
AMERICAN COAL BURNER COMPANY
Engineers

32-18 E. Erie St. Chicago 11, Ill.



● Chemical deposits found in water vary from place to place and from time to time.

● Your Boiler Feedwater Treatment must be individually prepared to cope with the water problems in your locality. It must be periodically checked to observe chemical changes. It must be geared to your operating conditions.

● DRY PINK Boiler Feedwater Treatment is an individual formula prepared by our Chemical and Engineering Staff after a complete analysis of your boiler feedwater is made. This scientific product will dissolve and remove scale now present. It will prevent further accumulation of scale and corrosion.

● Our work does not end with the preparation of the special DRY PINK formula. The work is carried on by the coordinated efforts of the Service Technicians working in the field, and our Laboratory Technicians. Periodical check-ups are made in your plant. Your boiler room equipment is inspected and recommendations are made for the maximum boiler efficiency.

● To prolong the life of your boiler—to increase its efficiency—to reduce fuel and maintenance costs—use DRY PINK. Write for full particulars.

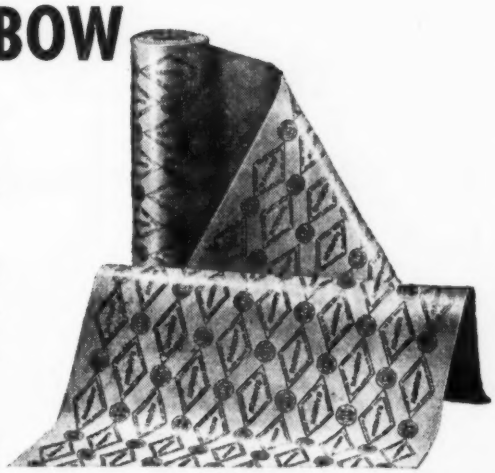
Dominion CHEMICAL CO., *Inc.*
WATER CONSULTANTS AND CHEMISTS
FOR INDUSTRIAL AMERICA
11 WEST 42nd ST. • NEW YORK 18, N.Y.

YESTERDAY HE SENT HIM OUT FOR GASKETS AND HE ASKED WHERE THE FUNERAL WAS
GET THAT OUT OF HERE BEFORE I GO NUTS. I WANT TO PACK A FLANGE NOT A SET OF DISHES!
IF HE SENT HIM FOR A WRENCH HE'D COME BACK WITH A STRAINED BACK
PULLING A PACKING BONER IS A SURE FIRE WAY TO GET THE BOSS STEAMED UP
YOU SENT ME FOR PACKING BOSS AND THIS LOOKS LIKE PACKING TO ME
PICK RAINBOW AND STAY OUT OF TROUBLE
WHEN HE GOES BACK FOR THE PACKING HE'D BETTER BRING RAINBOW OR THE BOSS WILL MAKE HIM SEE STARS

IT *stays* PACKED WITH RAINBOW

For 56 years Rainbow has been the packing that will not squeeze or blow out in service. Whenever you pack a flange or parallel surface with this original Red Sheet Packing, it *stays* packed.

Rainbow, the original Red Sheet, is designed for packing against hot or cold water, air, saturated steam pressures up to 150 pounds, and all hydraulic conditions. It fills up every irregularity in the flange.



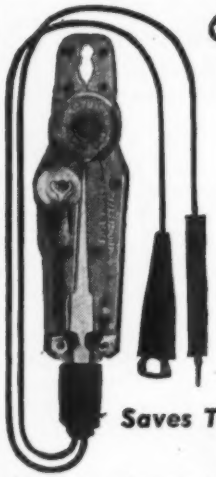
Serving Through Science with Mechanical Packings for All Industry

UNITED STATES RUBBER COMPANY

Serving Tnrough Science

1230 SIXTH AVENUE • ROCKEFELLER CENTER • NEW YORK 20, NEW YORK

The STAR ★ Fuse Puller and Circuit Tester



DOES **3 BIG Jobs**

1—Safely removes blown fuses
2—Quickly locates dead circuits
3—Replaces old-fashioned test lamps.

Indispensable for

Electricians
Engineers
Maintenance Men

Saves Time, Prevents Shock or Injury
Eliminates Guesswork

Made of a Transparent Plastic having in one of the legs a small lamp in series with a resistance and can be used to test 110 to 250 volts circuit. It will pull fuses from 10 to 100 Amperes. Thousands of electricians find this tool handier than Test Lamps. Requires the use of only ONE hand to quickly and accurately test circuits.

Lamp is Replaceable

Manufacturers of power driven machinery supply these Pliers with their machines, and earn the thanks of the maintenance men and operators.

Retails at $2.75 each, $1.50 additional for Leads.

Can be obtained from General Electric or Westinghouse Stores; also from jobbers in every large city

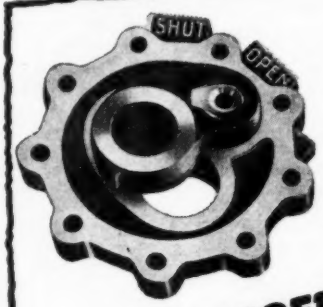
STAR FUSE CO. 239 Canal St., New York 13, N. Y.

HOPPES
FEEDWATER HEATERS

Deaerating and Non-Deaerating

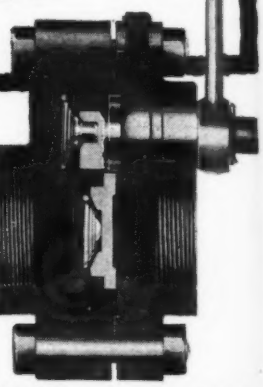
Write for Bulletin

THE HOPPES MFG. CO.
Established 1881
SPRINGFIELD OHIO



better than hand-lapped

A SELF-LAPPED VALVE SEAL!



It's true . . . the discs and seats on EVERLASTING valves *are* hand-lapped to secure the drop-tight seal when the valves are built. But it's the repeated self-grinding, self-polishing, SELF-LAPPING of the disc on the seat—every time this valve is used — that maintains the famous EVERLASTING drop-tight seal . . . *without maintenance!*

WITHOUT MAINTENANCE

This valve disc does not merely slide open and closed, as in the usual gate valve. This disc actually *rotates* within the disc-arm as it moves across the seat . . . SELF-LAPPING these sealing faces to microscopic precision. And the disc travels in constant contact with, and on, the seat table—they're never separated—so no grit or other substance can lodge between these sealing faces. The EVERLASTING drop-tight seal truly *improves with use!*

IMPROVES WITH USE

Changes of temperature cannot cause this valve to bind, because *all parts* function in a parallel plane . . . are free to self-compensate any expansion or contraction of individual parts. The disc, like all other internal parts, cannot become loose and choke the straight-through flow. And, since there is absolutely no wedging action in this valve—it *cannot stick!*

CANNOT STICK

A DEPENDABLE valve, well worth your learning more about—so why not write today for our Bulletin?

EVERLASTING VALVE CO., 49 Fisk St., Jersey City 5, N. J.

Everlasting Valves

FOR EVERLASTING PROTECTION

LOOK OUT FOR SOOTY!

Sooty will squander many dollars for you unless you stop him

ALKEN CERTIFIED SOOT-OFF is the triumphant conqueror of that wasteful rascal, soot, and his close relative, fire scale. The use of ALKEN'S CERTIFIED SOOT-OFF eliminates from the tubes 70% of all soot, fire scale and gum residue, due to oil or coal.

ALKEN CERTIFIED SOOT-OFF contains no ingredients which will harmfully affect metal, cement or fire brick . . . cannot burn explosively . . . when heated does not give off gases harmful to animal or plant life . . . reduces the necessity for shut-downs . . . removes soot, carbon and fire scale that cannot be readily reached by mechanical equipment.

Take advantage of our "personalized service," which means that a written survey of your boiler operation will be submitted to our Engineering Department before any treatment is recommended. After careful study, the formula best suited for your needs is sent to you.

Illustrated booklet sent free upon request.

For "top" boiler efficiency, use ALKEN CERTIFIED SOOT-OFF!
Reg. U. S. Pat. Off

ALKEN-MURRAY
CORPORATION

1841 Broadway, Dept. BB — New York 23, N. Y.

ALKEN CERTIFIED PRODUCTS
Water Treatments
Soot Removers
Sludge Removers

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Let MANZEL Force Feed LUBRICATORS Protect Your Machinery Investment

Expensive machinery deteriorates rapidly unless it gets the right amount of oil, at the right time, in the right places.

Manzel Lubricators deliver exactly the required amount of oil with clock-like regularity day in and day out. Individual pumping units, one for each lubrication point, insure correct lubrication at every point of friction. The individual units can be removed for servicing or replacement without stopping engine or affecting other units. Manzels start, stop, speed up and slow down with the engine.

Write for Catalog 25-D

MANZEL BROTHERS COMPANY, 326 Babcock Street, Buffalo 10, N. Y.

THIS STANDS FOR HONORABLE SERVICE TO OUR COUNTRY

Are You a Manufacturer's Agent Outside the U. S. and Canada?

American manufacturers are already, or will soon be, seeking representatives in the newly-freed countries of Europe, and in Latin America, Africa and the Near East. If you wish to represent American makers of power equipment, accessories and supplies, please write to E. J. Tangerman, POWER, 330 W. 42nd St., New York 18, N. Y., U. S. A., indicating territories desired, products you wish to represent, present lines, if any, banking references and any other pertinent data.

Wiedeke Ideal Tube Expanders

Fig. 40 Ideal Ace Tube Expanders, used for most types of Stationary, Locomotive and other Fire Return Tubular Steam Boilers. In 52 years of rolling they have achieved a most enviable record for service, economy and durability.

WIEDEKE IDEAL FLUE TOOLS DAYTON

TRADE MARK ASSURANCE OF QUALITY

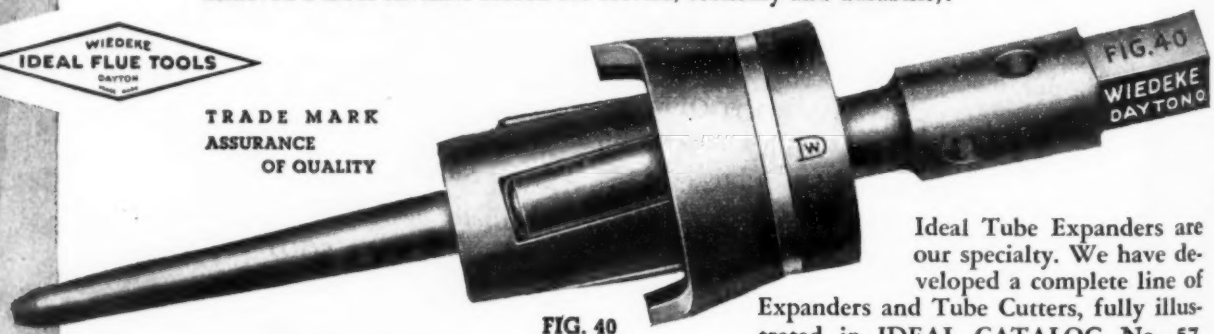
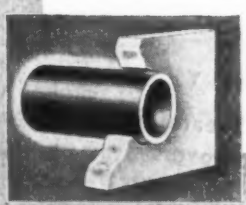
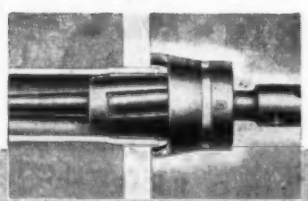


FIG. 40

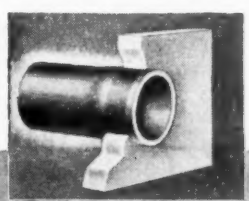
Ideal Tube Expanders are our specialty. We have developed a complete line of Expanders and Tube Cutters, fully illustrated in IDEAL CATALOG No. 57.



Tube set in sheet with proper projection for bead.



Tube rolled steam tight in sheet.



Tube ready to be beaded.

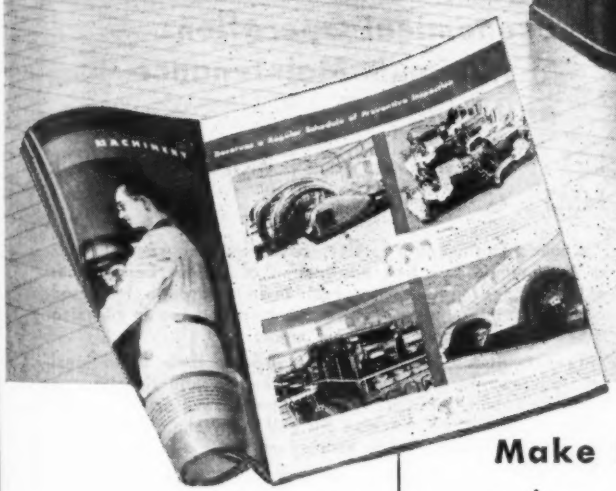
The Gustav Wiedeke Company

DAYTON 1, OHIO · U.S.A.

Safeguard

POWER PLANT OPERATION WITH MAGNAFLUX*

FIELD INSPECTION SERVICE!



Make It Part of Your Inspection Routine!

Fatigue cracks, and other typical flaws that develop in power plant equipment, can be detected before they cause major damage or costly shutdowns . . . Such failures are predictable and avoidable. Early detection is half the battle of protection.

Two basic inspection methods involving the use of Magnaflux, Magnaglo, and Zyglo are combined in MAGNAFLUX FIELD INSPECTION SERVICE. Magnaflux, Magnaglo and Zyglo—can be applied to a broad range of equipment. Non-magnetic materials can be inspected as well as magnetic. The inspections are speedy and non-destructive.

Inspection can be scheduled to coincide with your periodic teardown and overhaul work. *Write today for full details.*

Ask for This New Illustrated Bulletin

When you write for information, ask specifically for this new bulletin which features interesting facts about Magnaflux Field Inspection Service—that guards against equipment failure. Magnaflux Field Service Engineers are located throughout the country to serve you quickly.

MAGNAFLUX CORPORATION

Magnaflux—Magnaglo—Zyglo—Registered, U. S. Patent Office, trade names of the Magnaflux Corporation applied to its equipment and materials for magnetic particle and fluorescent penetrant inspection.

MAGNAFLUX CORPORATION

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PIPE CUTTING

with

Less Effort, More Speed

●That unusual thin-blade wheel knifes right through pipe, quickly, easily and practically without burr — because it's made of tool-steel, coined from heavy sheet, heat-treated and assembled in its solid hub. In the warp-proof malleable heavy-duty cutter frame it always cuts true, saves you time and effort. Made in 5 sizes for pipe to 6". Order from your Supply House—we're doing our best to supply everybody.

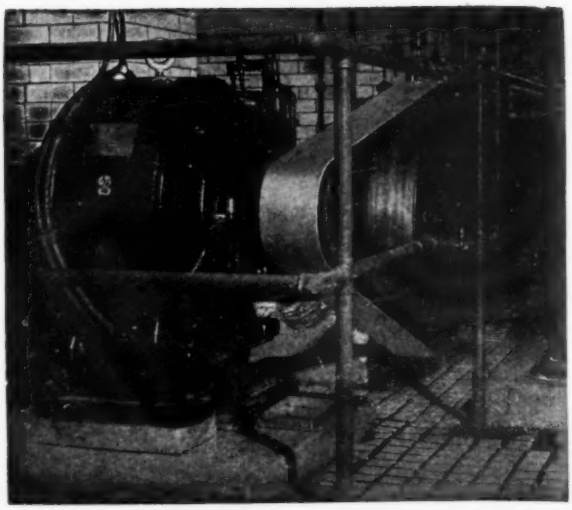
RIDGID *No. 42 and 44 4-wheel Cutter with short handle for cutting in tight places, cuts quickly with quarter turn.*

RIDGID

WORK-SAVER PIPE TOOLS

THE RIDGE TOOL COMPANY · ELYRIA, OHIO, U. S. A.

Specify . . . RHOADS TANNATE



the LEATHER BELTING

that gives you these advantages—

√ Reliable, Efficient *Economical* Operation

√ Minimum Maintenance and *Long* Life

LET RHOADS ENGINEERING SERVICE HELP YOU PLAN—

Rhoads Engineering Service, based on long specialization in the manufacture and application of leather belting, has helped many firms secure real savings through increased efficiency of their drives. We can help you too in planning a new drive or changing an old one.

Tannate-Rockwood drives have proved their exceptional reliability during recent years in maximum production through controlled belt tension. Tannate belts have unusual grip. They resist moisture, machine oils and many chemicals. Little maintenance is required to assure long life.

Write for our helpful pamphlet—"Better Service Belt Hints"

Rhoads

Tannate

WATERSHED LEATHER BELTING

J. E. RHOADS & SONS • Est. 1702

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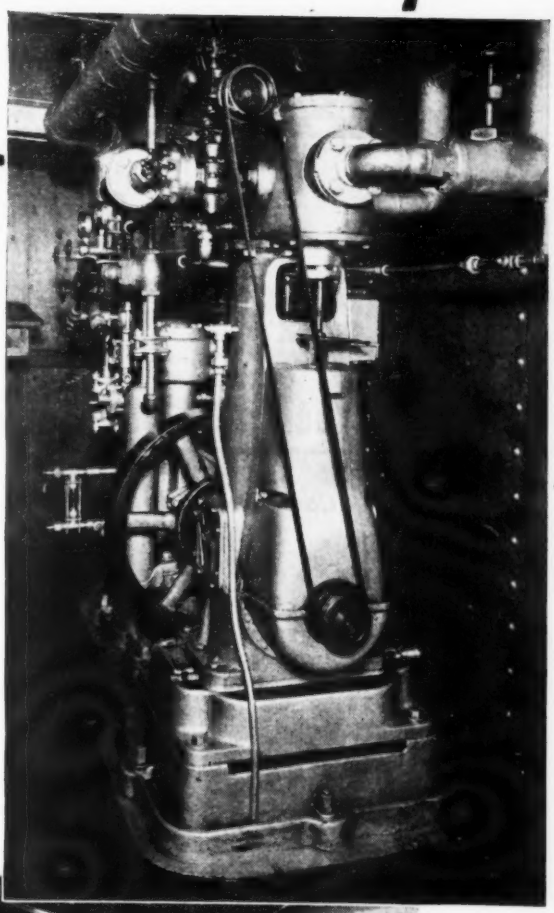
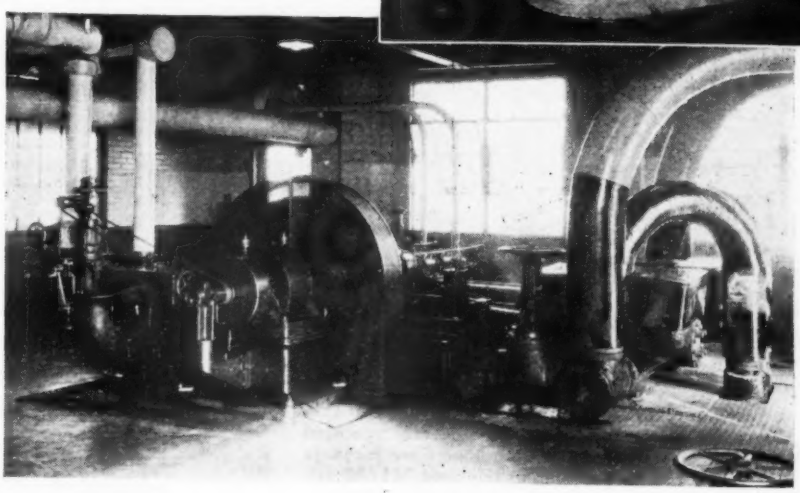
One More Place to Look
FOR REDUCTION IN POWER COSTS



IMPROVED designs of stokers and boilers are helping plants offset rising fuel and labor costs in steam generation, but that is not the limit to which economies can be carried. In most plants where steam is generated for processing purposes another important saving can be made by utilizing By-Product Power in the steam.

In many cases, steam passes through a pressure reducer before passing to its ultimate destination. To obtain By-Product Power, pass the steam through a Troy-Engberg Steam Engine, instead of the pressure reducer. The power thus converted can be used to drive generators, stokers, compressors, ventilating systems and many other types of equipment. Power savings thus effected will quickly pay for your Troy-Engberg Engine — in some instances in as little as six months.



Ask for Troy's recommendations in your own set-up. There is no obligation, of course.

Send for Bulletin 306

TROY ENGINE and MACHINE CO.

Established 1870

2505 Railroad Avenue **Troy, Pennsylvania**

8-TEM-2

WE are offering a complete and improved line of automatic Oil and Gas-Fired Steam and Hot Water Generators

known as

THE AMESTEAM GENERATOR

The Design and Construction is the result of Experience gained through the manufacture by us of thousands of Automatic Oil and Gas Fired Units operating in all parts of the world, plus—

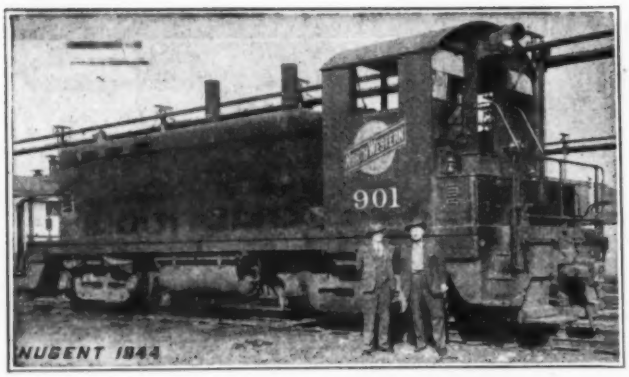
100 Years of Boiler Building Experience in all types of Boilers

Consult our Engineers about your Boiler Problems or Requirements

AMES IRON WORKS *Oswego, N. Y.*

1576 ENGINE HOURS

. . . on one recharge set



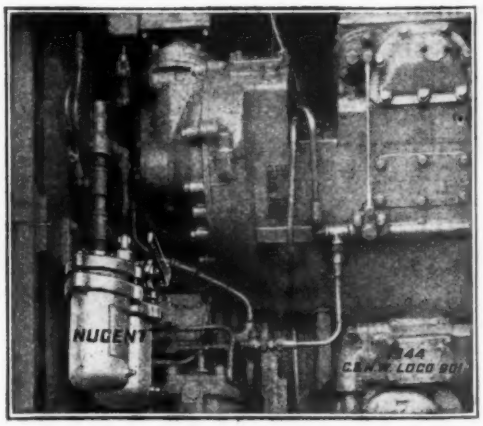
"No. 901"—a 900 h.p., 2 cycle Diesel switcher moving variable loads around curves and up and down ramps—recently operated 1576 engine hours without replacing the absorbent filter recharge in its Nugent Duplex Fuel Oil Filters. During this time 283,680 gallons of fuel oil were filtered and the engine consumed 8,012 gallons. The balance of the oil was by-passed back to the storage tank.

That's the kind of filtering that means maximum Diesel engine efficiency and the ultimate in oil conservation.

Get full details on the complete line of Nugent Fuel and Lube Oil Filters . . . write for Bulletin No. 7A.

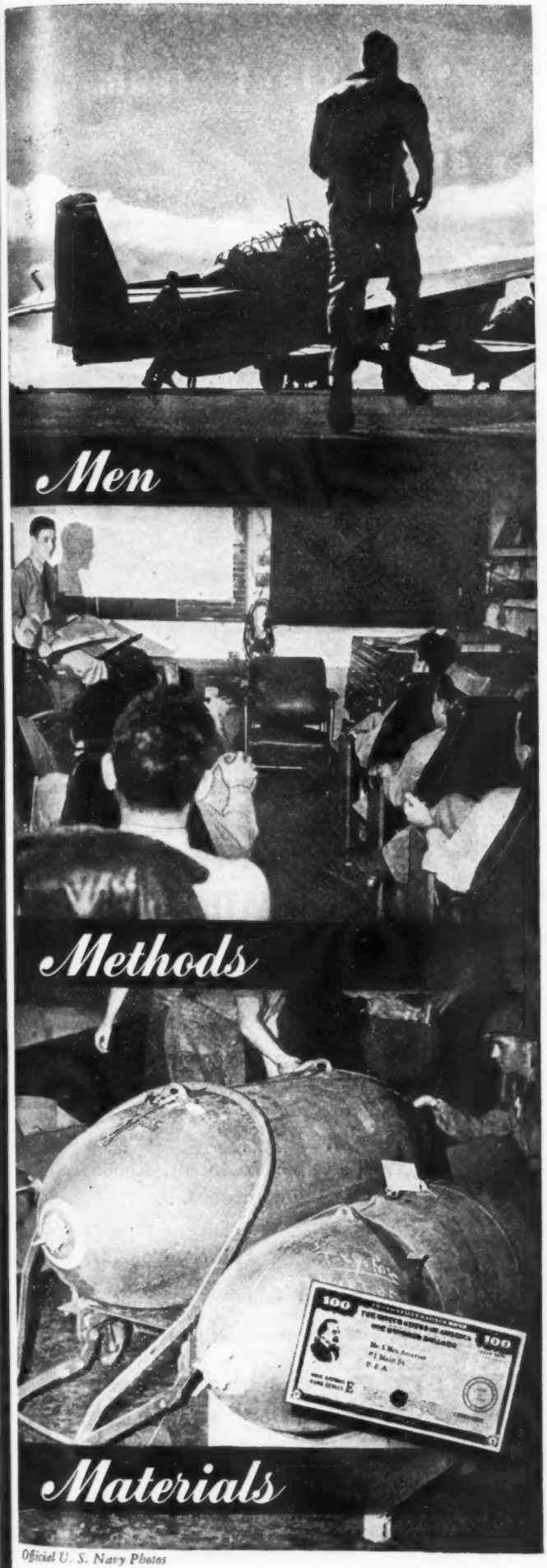
WM. W. NUGENT & CO., INC.
EST. 1897
417 N. HERMITAGE AVE., CHICAGO 22, ILL.

. . . and perfect filtration. That's the performance record of a NUGENT Duplex Fuel Oil Filter installed on the Diesel switching locomotive shown at left.



The above view shows the Nugent Duplex Fuel Oil Filters installed in the Diesel locomotive shown at the left. The throw-away type filter recharge used in these filters is easily and quickly inserted in the filter cage, assuring the user of constant, thorough filtering.

NUGENT FILTERS



Official U. S. Navy Photos

PRECISION BOMBING THAT AMAZED THE WORLD!

The smoke billowing over Tokyo, the blazing destruction that's underneath, come from the invincible combination of Men, Methods and Materials. Men—carefully picked and arduously trained for their task. Methods—developed to bring unerring results. Materials—best for their purpose, the final step that brings us nearer ultimate victory!

Men, methods and materials make for insulation efficiency

All the elements properly coordinated—men, methods and materials. This is the RUBEROID way to assure maximum service from industrial insulation.

MEN . . . The right men are all-important. Skilled mechanics in the nationwide organization of Ruberoid Approved Applicators handle the jobs. These men know their business. They've licked the most difficult insulation problems.

METHODS . . . Each installation is "tailor-made" to meet the individual job. Ruberoid engineers are not wedded to any one method. You get the benefit of broad experience with all methods of application.

MATERIALS . . . The right insulation material to meet your specific temperature control problem. The Ruberoid line has no "gaps" in it from 0° to 1900° F.

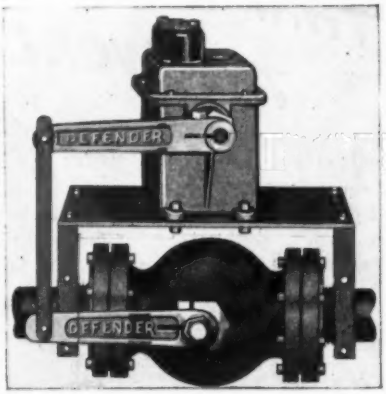
RUBEROID
INSULATION
A complete service

Write for Ruberoid Insulation Guide and technical data.

The RUBEROID Co., *Executive Offices*, 500 Fifth Ave., New York 18, N. Y.

ASPHALT AND ASBESTOS BUILDING MATERIALS

Defender Improved (Fitts Type) Adjustable Chronometer Valves



The longest lived Valve made for Hot Water or Steam or any other corrosive Fluids that would soon wear out any of the Piston or single or double seated Valves.

This Chronometer Valve only requires an eighth turn to open and close and it can be Motor operated as illustrated above or it can be hand operated or float operated and we show in our new Bulletins E-3 & E-4 a complete line of Pressure and Vacuum Stats and Temperature, Float and Liquid level as well as Feed Water Regulator Stats.

A new 32 Page Pocket Catalog No. 16 which has 166 illustrations, is now ready for distribution. Write for it.

DEFENDER INSTRUMENT & REGULATOR CO.
ST. LOUIS, MO.

LIQUIDOMETER
Tank Gauges

ALWAYS DEPENDABLE

FOR GAUGING LIQUIDS OF ALL KINDS

100% AUTOMATIC

APPROVED BY UNDERWRITERS' LABORATORIES

WRITE for COMPLETE DETAILS

"LIQUIDS WORTH STORING ARE WORTH MEASURING"

THE LIQUIDOMETER CORP.
39-16 SKILLMAN AVE., LONG ISLAND CITY, L.I., N.Y.

Fast Efficient Steam Starts Here...

...in a matter of minutes with

O & S *Powermaster*
STEAM GENERATING UNITS

Do your future plans call for boiler room changes? — replacing your old boiler?

The O & S Powermaster is a simply-designed, self-contained oil-fired steam generating unit, wired, mounted, ready to produce needed steam in a few minutes. Sturdy—safe—clean—compact—space saving. Before you buy an ordinary boiler, get the facts on the speedy, economical "packaged" O & S Powermaster . . .

Write for Bulletin No. 1213 — to Orr & Sembower, Inc., 974 Morgantown Rd., Reading, Pa.

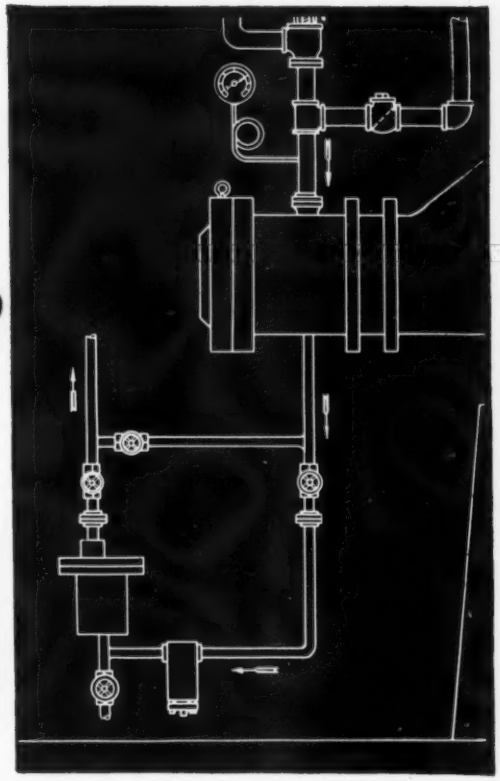
ORR & SEMBOWER INC.

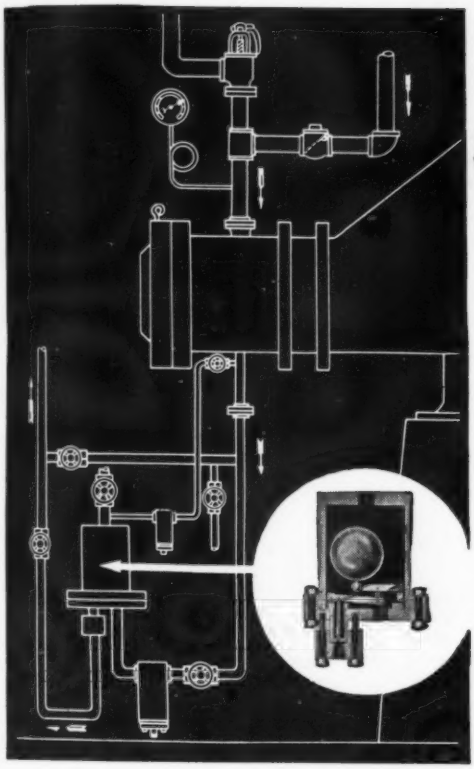
READING O&S PENNA.

Builders of Better Boilers Since 1885

PROBLEM: MORE ACCURATE TEMPERATURE CONTROL

What would you do?





HERE'S STRONG'S SUGGESTION

Latest refinery practices on reboiler and reflux unit installations include sensitive control instruments on steam supply to maintain the exact temperature required for precise "cuts".

Both Strong open and inverted bucket type traps discharge intermittently, providing a purging action as a part of the operating cycle. This feature, so desirable under most conditions, may result in instrument "lag" in time-temperature processes. On this job condensate must be drained *continuously*.

Working with the STRONG complete line—STRONG engineers have been able to recommend STRONG continuous flow float traps. Compact and dependable, these traps are now in service, permitting more precise "cuts" and insuring successful reactions in this important refinery production phase.

We Furnish the HOW as well as the WHAT WITH!

Steam systems will operate with many different types and applications of traps, reducing valves and other specialties.

They operate best only when the *right* units are installed to *best* advantage. That calls for intimate knowledge of your problem, experience with all types of steam specialties—and a complete line to give you the benefit of the unbiased recommendation.

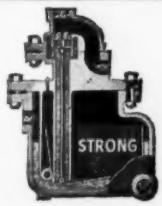
Strong engineers are always ready to help. You can be sure that their recommendations will be backed by long experience with the complete STRONG line, including open and inverted bucket, closed float, float - and - thermostatic (blast) traps, etc.—forged, fabricated (welded) cast and semisteel construction. Send your problems to Strong, Carlisle & Hammond Company, Cleveland 13, Ohio.

STRONG, CARLISLE & HAMMOND COMPANY
Cleveland 13, Ohio

REG. TRADE MARK **OTHER** ANUM-METL Reg Trade Mark
STRONG
STEAM SPECIALTIES

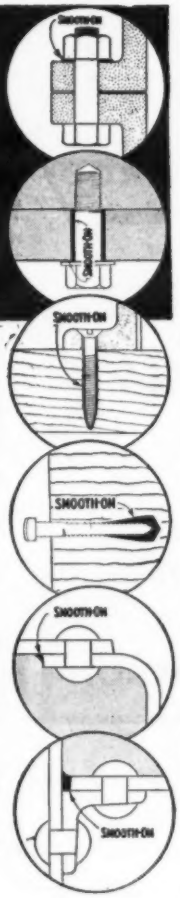
Reducing Valves

Strainer



Open Bucket Trap

"Little" Repairs THAT OFTEN SAVE Big Expense



One loose bolt, nut, screw or rivet can cause a breakdown, delayed production, much expense. Caught in time and tightened with

SMOOTH-ON No. 1

Iron Repair Cement, the trouble and expense are averted.

Bolts and nuts worn or stripped loose are easily made tight again with an application of Smooth-On No. 1.

Wood screws that have lost their grip, whether set against the grain or with it, take hold firmly again when coated with Smooth-On No. 1.

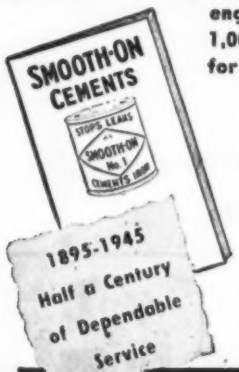
Leaking riveted seams and joints can be made water- and air-tight again with Smooth-On No. 1, and no need of using heat or special apparatus.

And these repairs *last*. Because Smooth-On expands slightly as it sets, filling cracks and crevices and openings tightly, firmly, resistingly.

Get Smooth-On No. 1 from your supply house. If they haven't it, write us. Packed in sizes from 7 on up.

FREE *40-page Repair Handbook*

Gives clear-cut directions for repairing plant and home equipment of many kinds. 170 diagrams. A book every engineer and mechanic wants — over 1,000,000 now in circulation. Send coupon for your copy.



Mail This Today

Smooth-On Mfg. Co., Dept. 30, Communipaw Ave., Jersey City 4, N. J.

Please send me my copy of the Smooth-On Repair Handbook

Name .....

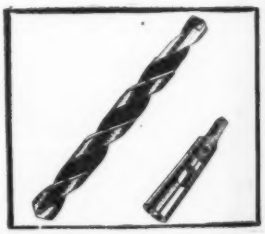
Address .....

8-45 .....

Do it with SMOOTH-ON
The Iron Repair Cement of 1000 Uses

New Shankless Roll-Forged Drill is Faster, Tougher, More Economical

Developed by Ford for wartime uses —available now to industry in general. "More holes at less cost," is the claim for this ingenious new Shankless high speed drill—made in two parts—the drill itself, and a removable taper shank, known as the "drill driver." By this separation, costs to the user have been cut 20% to 30% under conventional taper-shank drills. In the conventional drill, the shank must be discarded when the point and flutes are worn out. Here, however, the drill driver is used throughout the lives of many drills. Shankless drills are roll-forged and twisted, unlike the machined manufacture of ordinary drills, for improved structure.



Shankless Drill and "Drill Driver"

Principal advantages are (1) Lower first cost. (2) Greater hole production because of greater strength. (3) Reduced breakage with tough "shock-absorber" neck. (4) Greater length of usable flute. (5) Greater scrap recovery value of unused portion of drill.

Wartime advantages of Wrigley's Spearmint Gum show how this quality product, too, can help industry—once it again becomes available. In the meantime, no Wrigley's Spearmint Gum is being made; and none will be made, until conditions permit its manufacture in quality and quantity for everyone. That is why we ask you to "remember the Wrigley's Spearmint wrapper," as the symbol of top quality and flavor—*that will be back!*

Remember this wrapper

You can get complete information from Republic Drill & Tool Co. 322 S. Green St., Chicago 7, Ill.

Z-79

Quick FLOOR. . .

INSTANTLY . . . PERMANENTLY REPAIRS FLOOR SURFACE DEFECTS

ENEMY TO LOST MOTION

READY-MIXED . . . EASILY LAID

Quick-Floor makes a smooth, long-lasting, heavy-duty traffic floor patch in one minute without interrupting or re-routing traffic. It repairs cracks, spalls, chuck holes and worn spots in all industrial floors of concrete, metal, etc.

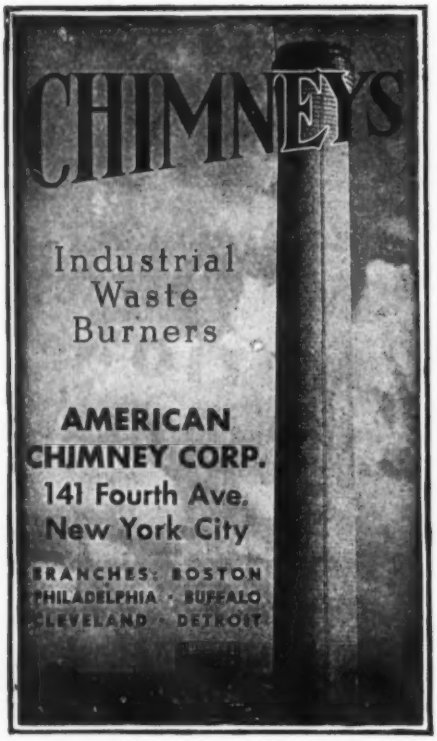
Quick-floor smooths grades, ramps, curves, and all abrupt floor changes which cause hard pulling, jarring and upsetting of heavy loads on small-wheeled trucks. Often saves complete cost at trifling repair expense.

So simple are repairs made with Quick-Floor that anyone can do it. Satisfaction guaranteed.

Dura-Tred floor engineering service is freely available to anyone having a special floor-surfacing problem. Write for Bulletin and prices today.

Extra heavy wire cleaning brush and Iron Tamper supplied FREE with first 55 gallon order.

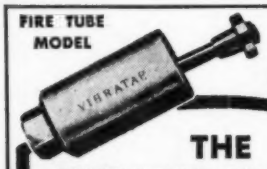
DURA-TRED COMPANY 351 N. CENTRAL PARK BLVD. CHICAGO 24, ILLINOIS.



WHERE TO BUY

Featuring additional products and specialties for power plants

FIRE TUBE MODEL



QUICK TUBE CLEANING

THE VIBRATAP CLEANER

Does a fast and thorough job of removing scale from boiler tubes—saves coal, improves boiler performance. Write for Bulletin V-20.

BRUNT EQUIPMENT CO.
60 S. DIVISION ST. · BUFFALO, N. Y.

Automatic Control

POWERS TEMPERATURE and HUMIDITY CONTROL

For Industrial Processes, Heating and Air Conditioning Systems, Hot Water Heaters and Shower Baths. Write for Bulletins.
Offices in 47 Cities
2771 Greenview Ave., Chicago, Ill.
THE POWERS REGULATOR CO.

THE ORIGINAL
Tripp Metallic Packing
TRIPP METALLIC PACKING CO.
BOSTON MASS.

"MONO"
BOILER BAFFLES
HIGH TEMPERATURE
Refractory Cements
SANFORD C. SMITH REFRACTORIES, INC.
1715 NIAGARA ST., BUFFALO, N. Y.

Make it your habit
to check, each issue, the announcements appearing in this
WHERE TO BUY SECTION
They supplement other advertising in POWER of products and services essential to modern power plant operation.

PROFESSIONAL SERVICES

THE BIRD-ARCHER CO.
Engineers and Consultants on Water Conditioning Problems
Surveys . . . Plant Studies . . . Analyses
400 Madison Ave. New York, N. Y.

LUKE L. NAKASHIAN
Engineer
PROCESS STEAM PLANTS
POWER PLANTS
OIL REFINER EQUIPMENT
404 Park Square Building, Boston 16, Mass.

STANLEY ENGINEERING COMPANY
CONSULTING ENGINEERS
Power Plants
Steam - Diesel - Hydro
Design - Construction - Test - Valuation
Central State Bank Bldg., Muscatine, Ia.

H. E. CORL
CONSULTING ENGINEERS
Design Supervision of Construction Management
Industrial and Municipal Power Plants
Steam and Diesel
Steam and Electric Power Distribution Systems
Plants Surveys Appraisals Reports
1316 Arch Street Philadelphia, Pa.

PUBLIC UTILITY ENGINEERING & SERVICE CORPORATION
CONSULTING ENGINEER
Design Operations
Steam - Hydraulic - Gas
231 S. LaSalle St., Chicago (4), Ill.

JOHN A. STEVENS Inc.
Established 1909
CONSULTING ENGINEERS
Power Plants Paper Mills
Dye Houses Surveys
Lowell, Massachusetts

E. R. GARLOCK & ASSOCIATE ENGINEERS
Industrial Mechanical & Electrical Maintenance Engineers
Complete plant and power maintenance, rehabilitation, installation, construction, inspections, performance and efficiency supervision.—Emergency repairs. High pressure power units a specialty.
624 Ecton Road Akron 3, Ohio

SANDERSON & PORTER
Engineers - Constructors
FINANCING DESIGN REORGANIZATION CONSTRUCTION
of
INDUSTRIALS and PUBLIC UTILITIES
Chicago New York San Francisco

STONE & WEBSTER ENGINEERING CORPORATION
Design and Construction
Reports • Examinations • Appraisals
Consulting Engineering
BOSTON • NEW YORK • CHICAGO • HOUSTON
PITTSBURGH • SAN FRANCISCO • LOS ANGELES

GILBERT ASSOCIATES, INC
ENGINEERS AND CONSULTANTS
Power Plant Design and Construction
Rehabilitation and Maintenance
Steam — Diesel — Hydro
Reports—Examination—Laboratory
Industrials and Utilities
61 Broadway New York
National Press Bldg. Washington, D. C.

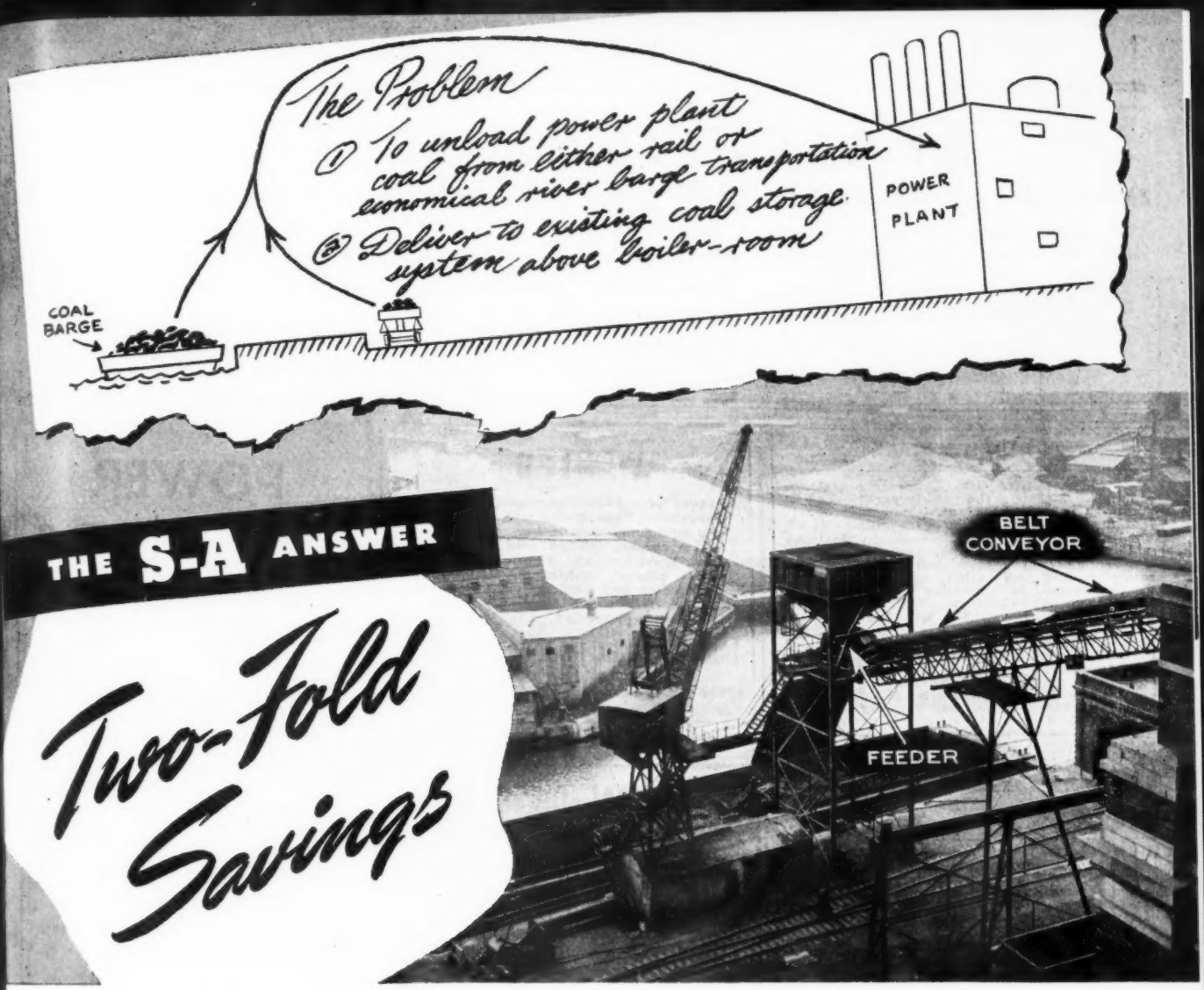
SARGENT & LUNDY
ENGINEERS
140 South Dearborn St.
CHICAGO, ILLINOIS

THE J. G. WHITE ENGINEERING CORPORATION
Design • Construction • Reports • Appraisals
80 Broad Street, New York 4

HALL LABORATORIES, Inc.
R. H. HALL, Ph.D Director
CONSULTANTS ON
BOILER WATER CONDITIONING
Hagan Building Pittsburgh (30), Pa.

J. E. SIRRINE & COMPANY
Power Plants Design Water
Engineers
Consultation Reports Plans
Steam Utilization
Greenville South Carolina

WHITMAN, REQUARDT AND ASSOCIATES
Engineers - Consultants
Power Plants — Industrial Plants
Steam and Electric Distribution Systems
Waterworks and Sewerage
Reports—Plants—Supervision—Appraisals
1304 St. Paul Street Baltimore 2, Md.


The Problem
① To unload power plant coal from either rail or economical river barge transportation
② Deliver to existing coal storage system above boiler-room
POWER PLANT
COAL BARGE
THE S-A ANSWER
Two-Fold Savings
BELT CONVEYOR
FEEDER

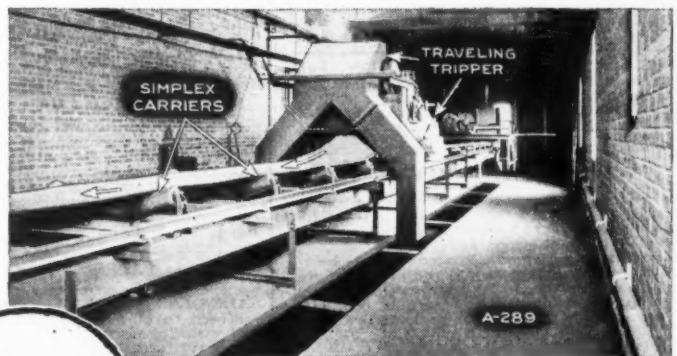
The belt conveyor from water front loading hopper to building is operated at maximum practical angle to reduce the height of the hopper. The crane shown can unload from either barges or cars.

Here's another outstanding case where S-A engineers worked out a practical, efficient system in answer to a specific problem. This power plant wanted to cut coal handling costs by bringing coal in by barge.

The S-A system shown was the logical economical answer . . . with *double savings* for the company: (1) It permits fast handling of coal brought in by rail or more economical water transportation, and (2) it makes use of existing coal handling equipment . . . keeping new equipment and installation expense to a minimum . . . Simply a Hopper, Reciprocating Plate Feeder, and inclined Belt Conveyor, all fed by a crane which can dip into either barge or car for its load.

★ ★ ★

S-A Belt Conveyor and self-propelling, self-reversing Belt Tripper to distribute coal to all parts of overhead boiler room bunker.



STEPHEN S-A ADAMSON MFG. CO.

6 RIDGEWAY AVENUE, AURORA, ILLINOIS — LOS ANGELES, CALIF. ★ BELLEVILLE, ONT.

Designers and Manufacturers of All Types of

BULK MATERIAL HANDLING EQUIPMENT

SEARCHLIGHT SECTION

EMPLOYMENT • BUSINESS • OPPORTUNITIES • EQUIPMENT—USED or RESALE

UNDISPLAYED RATE:

(Not available for equipment advertising)

15 cents a word, minimum charge $3.00.
(See ¶ on Box Numbers.)
POSITIONS WANTED (full or part-time individual salaried employment only), ½ the above rates.
PROPOSALS, 75 cents a line an insertion.

INFORMATION:

BOX NUMBERS in care of any of our New York, Chicago or San Francisco offices count 10 words additional in undisplayed ads.

DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED RATE:

The advertising rate is $7.00 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page.

NEW ADVERTISEMENTS received by August 15th will appear in the September issue, subject to limitations of space available.

POSITIONS VACANT

WANTED: MECHANICAL and structural designer-draftsmen, thoroughly experienced in steam-electric power plant design and including piping and other related detailing. Work on drafting board. Send synopsis of training and experience including references, representative samples of design and draftsmanship, salary desired and earliest date could report for employment in Consulting Engineer's office. Location North Carolina. WMC regulations apply. P-838, Power, 330 W. 42nd St., New York 18, N. Y.

CHIEF DESIGN Engineer for old established valve manufacturer of automatic control equipment, permanent position as head of engineering department, advise age and qualifications. P-847, Power, 330 W. 42nd St., New York 18, N. Y.

MECHANICAL ENGINEER familiar with steam power plant work for permanent position with midwest engineering firm as assistant to head of mechanical engineering section. Good opportunity. Give complete experience record and statement of availability. P-865, Power, 520 N. Michigan Ave., Chicago 11, Ill.

FIRE PROTECTION Engineers and Inspectors. Technical graduates, especially chemical and electrical, civil, mechanical, metallurgical also considered. Inspect and consult industrial plants to prevent fires, explosions, and other casualties. Considerable travel and report writing; interesting work offering permanency. Engineering experience necessary. Salary open. Well-known national organization with openings at Cleveland, Chicago and other district centers. Men under 34 years of age cannot be considered. Please send photograph when applying. P-865, Power, 330 W. 42nd St., New York 18, N. Y.

DESIGN ENGINEER—An unusual opportunity with large internationally known manufacturer of Air Conditioning and Refrigeration equipment for capable design engineer of refrigeration compressors and condensing units to work as assistant to chief. All replies will be confidential. Please outline qualifications. P-882, Power, 330 W. 42nd St., New York 18, N. Y.

RESEARCH ENGINEER—Unusual opportunity for capable engineer experienced in design and research work of air conditioning and refrigeration equipment to operate new modern laboratory for internationally known manufacturer of Air Conditioning and Refrigeration equipment. All replies will be confidential. Please give outline of qualifications. P-883, Power, 330 W. 42nd St., New York 18, N. Y.

WANTED: ONE experienced Boiler Sales Engineer and one experienced Heat Exchanger Engineer for New York office. Apply—Henry Vogt Machine Co., 80 Broad St., New York City, N. Y.

EMPLOYMENT SERVICE

SALARIED POSITIONS — This advertising service of 35 years recognized standing negotiates for high salaried supervisory technical and executive positions. Procedure will be individualized to your personal requirements and will not conflict with Manpower Commission. Retaining fee protected by refund provision. Identity covered and present position protected. Send for details. R. W. Bixby, Inc., 270 Delward Bldg., Buffalo 2, N. Y.

POSITIONS WANTED

WANTED—POSITIONS as shift engineer or assistant chief engineer in industrial power plant. Ten years experience on high pressure boilers and turbines. PW-876, Power, 330 W. 42nd St., New York 18, N. Y.

WANTED

Manager for our Machinery and Equipment Department Experienced with machinery and equipment used in heavy industries—like cranes, ground and overhead; steel buildings and structures, power plants, mining, contractors, etc. Drawing account and participation. Unusual opportunity for good high grade man. Confidences respected.

IRON & STEEL PRODUCTS, INC.
40 years' experience
13438-A S. Brainard Avenue, Chicago 33, Ill.
"ANYTHING containing IRON or STEEL"

TECHNICAL DIRECTOR

YOUNG MAN GOING PLACES!

The man we're looking for may not be a technical director now . . . . he may be an assistant. But he's a man with drive and ambition!

- Excellent opportunity in substantial manufacturing company with main office in New York. To fit the bill a
- knowledge of ALL phases of internal and external boiler feedwater treatment is ESSENTIAL.

Send complete resume with salary requirements; photo if possible.
This is an A-1 spot for the right man.

Our staff knows about this ad.

Reply **P-884,** Power
330 W. 42nd St., New York 18, N. Y.

POSITIONS WANTED

MECHANICAL ENGINEER, now employed, excellent references, extensive executive power plant operating experience, good record in handling personnel, experienced in heat balances and effecting economies, desires position preferably with concern operating several power plants. PW-875, Power, 330 W. 42nd St., New York 18, N. Y.

POWER OPERATING Engineer wishes to locate in the Eastern part of the U. S. At present supervising operation of high pressure, pulverized fuel, steam electric industrial power plant. Knowledge of Diesel engines. Eleven years practical experience. PW-877, Power, 330 W. 42nd St., New York 18, N. Y.

SALESMAN AVAILABLE

INDUSTRIAL SALESMAN—Widely acquainted with industrial field in Indiana, Ohio, Michigan and Illinois invites expression from manufacturers of industrial materials and equipment who desire experienced and intelligent representation. Graduate engineer. J. C. Orr, Brooklyn, Indiana.

SALESMEN WANTED

SALESMAN WANTED—Sales engineer with steam turbine experience. If you are qualified we offer permanent position with good future. Write fully. Replies strictly confidential. Dean Hill Pump Company, 4000 East 16th St., Indianapolis 7, Indiana.

SALES MANAGER wanted by old established manufacturer of water treating equipment. Must be good engineer, preferably chemical, and have eight to ten years experience in successfully selling to the water treating field. Also requires three sales engineers. Give full details in reply. SW-878, Power, 520 N. Michigan Ave., Chicago 11, Ill.

POWER ENGINEERS

Mechanical Engineers or Electrical Engineers, with aptitude and experience in heat balance thinking for work devoted to plant improvements, results engineering and effecting economy in the generation and consumption of steam, electricity, compressed air, water and refrigeration. Several openings for qualified men at different locations in the United States.

Give full experience, education, age, present salary and salary expected. Enclose snapshot.

Post-war opportunity.

Applicants must be able to obtain Statement of Availability.

E. I. du Pont de Nemours & Co., Inc.
Personnel Division
Wilmington 98, Delaware

Centrifugal Pump DESIGNER

Permanent Position with Post-War Opportunities

WANTED: Experienced centrifugal pump engineer, well grounded in hydraulics and with a thorough knowledge of the mechanical design of double-suction, axial flow and multi-stage centrifugal pumps.

Give full details of education, experience, present salary and salary expectations. All replies held in strictest confidence. Regulations of War Manpower Commission must be observed.

Address your reply to:

E. G. Landberg
GOULDS PUMPS, INC.
SENECA FALLS, NEW YORK

MECHANICAL DESIGNERS

Experienced in power, industrial, and processing plants. Location, New York City.

EBASCO SERVICES INC.
2 Rector St. N.Y.C. 6

(Additional Employment Advertising On Opposite Page)

The Austin Company

Invites Applications from Capable Engineers and Draftsmen

This invitation is not directed to men in urgent war work but rather to those who can consider more effective effort in the present execution of vital war plants under high priority ratings, and the opportunity to participate in an increasing amount of postwar private work.

To applicants who are ambitious, straight-thinking, and of sound education and training, this company offers positions with ample opportunity for advancement on the East Coast, Central West, Gulf Coast, or the West Coast.

Positions open are for experienced designers, draftsmen and recent college graduates qualifying in—

MECHANICAL

Industrial Plant Equipment * Process Piping * Power Plants * Heating Systems * Air Conditioning and Ventilation * Conveying Systems * Plumbing and Sewers * Sprinkler Systems * Precision Machine Design.

ELECTRICAL

Power Wiring A.C. and D.C. * Control Wiring * Industrial Illumination * Power Distribution * Electronic Applications * Radar * Controls.

National Headquarters

16112 EUCLID AVENUE — CLEVELAND — 12 — OHIO

DRAFTSMEN WANTED

for both Centrifugal and reciprocating pump work. Permanent positions and desirable working conditions. Experience in pump work preferred but all applicants will be considered.

WARREN STEAM PUMP CO., INC.
WARREN, MASS.

Industrial Supply Distributor requires services of experienced sales engineer to handle sales of Power Transmission Equipment for industrial plants in Virginia and North Carolina. Must have sales ability and a thorough knowledge of Motors, Variable Speed Transmissions, Speed Reducers; Silent and Roller Chain and Sprockets; Gears, Bearings, Pulleys and various types of belting; and their application. Splendid opportunity for active man possessing necessary engineering knowledge and sales ability.

SW-886, Power
330 West 42nd St., New York 18, N. Y.

SALES ENGINEERS!

With Mechanical or Chemical Engineering Background, Preferably With
- Boiler Plant Experience. Excellent Post-War Opportunity in Several Eastern and Mid-Western Locations for Hard Worker With Real Sales Ability. We Are Well Known Manufacturers of Chemicals for the Scientific Conditioning of Industrial Water. Write Fully—Age, Education, Sales Experience, Salary Requirements.

Reply SW-885, Power
330 W. 42nd St., New York 18, N. Y.

Bids: September 20, 1945

TURBINE GENERATOR SET

The A & M College of Texas, College Station, Texas invites bids F.O.B. College Station, Texas on one 375 KVA steam driven Westinghouse generator, impulsive type turbine 7245 RPM. Generator 60 cycles, 3 phase, 2400 volts, 900 RPM unit with 1000 sq. ft. condensor, circulating pumps, etc. Complete except switch board connections.

Unit is open to inspection any time.

Bids will be opened 2:00 PM in the office of the Business Manager September 20, 1945. The college reserves the right to reject any or all bids.

For details address B. D. Marburger, Superintendent of Utilities.

Professional Mechanical Engineer

with 30 years experience in design, operation, construction of large utility plants. Wants to represent one or more manufacturers in sales engineering. A wide acquaintance in the Engineering field, with a successful record of equipment development can be utilized to mutual advantage.

RA-881, Power
330 West 42nd St., New York 18, N. Y.

ATTENTION—SALES MANAGERS

A New England Industrial Sales organization with salesmen calling on the Industrial, Marine and Power Industries desires an additional line. Are you represented in New England, if not, write

RA-873, Power
330 West 42nd St., New York 18, N. Y.

Don't forget the

BOX NUMBER

When answering the classified advertisements in this magazine don't forget to put the box number on your envelope. It is our only means of identifying the advertisement you are answering.

Cash Ready

FOR YOUR

ELECTRICAL EQUIPMENT

Electric motors, AC and DC.
Compensators
Generators
Motor Generator Sets
Air and Oil Circuit Breakers
Panels
Exhaust Fans
Control Equipment

Send us list with full details

WIRE OR PHONE

POWER EQUIPMENT CO.
154 ANDREWS ST., ROCHESTER 4, N. Y.
Telephone Main 568 or 569

WANTED

DIESEL ENGINES

Total 1600 HP required, with or without Generators. Consider units 225 HP and larger. Also smaller high speed units for standby service. Preference given units immediately available. Give complete details and price.

Address Purchasing Department
W-844, Power
330 West 42nd St., New York 18, N. Y.

WANTED:

STEAM UNIT HEATERS

Total Required: 50,000 Sq. Ft. E.D.R.
Thermostatic Traps and Valves
State Size, Manufacturer, and Price.

W-879, Power
520 North Michigan Ave., Chicago 11, Ill.

WANTED

500 to 1000 K.W., 480 volt, 3 phase, 25 cycle steam turbine generator, condensing. Inlet condition in the range of 150 lb. to 225 lb. Ga., saturated—complete with condenser —surface condenser preferred.

W-874, Power
520 North Michigan Ave., Chicago 11, Ill.

REMEMBER "U.E.M." FOR THE FINEST IN POWER PLANT MACHINERY

Units listed available for immediate delivery

TURBINE-GENERATOR UNITS

3 phase, 60 cycle

3125 KVA G.E. 180-200 lbs. pressure, 500° TT, 2300 volts, 3600 RPM, equipped with surface condenser, condensing auxiliaries, exciter unit, switchboard with instruments (a complete installation).

1875 KVA G.E. condensing 175-200 lbs. pressure, 500° TT 6600 volts, 3600 RPM complete with condenser.

1875 KVA (2) Westinghouse condensing, 200 lbs. pressure, 100° superheat, 480 volts, 3600 RPM complete with jet condensers and auxiliaries.

1250 KVA Westinghouse non-condensing, 200 lbs. pressure, 500° T.T., 15 to 25 lbs. gauge back pressure, 480 volts, 3600 RPM., complete with exciter, switchboard panel and instruments.

1250 KVA General Electric condensing, 300 lbs. pressure, 200°F. superheat, 4000 volts, 3600 RPM complete with surface condenser and auxiliaries.

1250 KVA Elliott condensing, 175-300 lbs. pressure, 240 volts, 3600 RPM complete with jet condenser and auxiliaries.

937 KVA G.E. condensing 150-175 lbs. pressure, 2300 volts, 3600 RPM with direct shaft exciter, surface condenser and auxiliaries.

780 KVA Westinghouse non-condensing 175-200 lb. pressure, 15 lb. back pressure, 480 volts, 3600 RPM, complete with switchboard.

625 KVA Westinghouse non-condensing, 150-200 lbs. pressure, 35 lbs. gauge back pressure, 2300/480/240 volts complete with switchboard.

375 KVA G.E. condensing 150-200 lb. pressure, 100° SH, 2300 volts, 3600 RPM complete with surface condenser and auxiliaries.

125 KVA Westinghouse non-condensing, 175-200 lbs. pressure, 0-10 lbs. gauge back, 240 volts with direct connected exciter and switchboard.

ENGINE-GENERATOR UNITS

3 phase, 60 cycle

Alternating Current

900 KVA Allis Chalmers, 480 volts, 150 RPM generator direct connected to 24" x 36" Filer Stowell semi-Unaflow engine.

312 KVA Elliott, 4000/2300/550 or 240 volts, 180 RPM generator direct connected to a 17"x24" Elliott Unaflow non-condensing engine, 175 lb. pressure, 6 lb. back pressure.

312 KVA Westinghouse 240/480 volts, 200 RPM generator direct connected to Skinner Unaflow non-condensing engine.

200 KVA Crocker-Wheeler, 240 volts, 400 RPM generator direct connected to Ames vertical Unaflow engine.

188 KVA Crocker-Wheeler, 208/120 volts, 225 RPM generator direct connected to 17" x 18" Skinner counterflow engine, 135 lbs. pressure, 5 lbs. back pressure. Complete installation.

156 KVA General Electric, 240 volts, 225 RPM generator direct connected to Nordberg Unaflow engine.

125 KVA General Electric, 240 volts, 257 RPM generator direct connected to 17" x 16" Skinner Unaflow engine, 100 to 130 lbs. pressure, 5 lbs. back pressure.

93.8 KVA General Electric, 240 volts, 257 RPM generator direct connected to 13" x 15" Skinner Counterflow engine, 100 to 130 lbs. pressure, 5 lbs. back pressure.

SPECIAL OFFERINGS

1690 C.F.M. 110 lb. air pressure Ingersoll-Rand steam driven air compressor 125 to 150 lbs. steam pressure.

1590 C.F.M. 100 lb. air pressure Hardie-Tynes steam driven air compressor 150 to 175 lbs. steam pressure.

500 KVA G. E. 3 phase, 60 cycle, 2300 volt, 450 RPM belted generator.

ENGINE-GENERATOR UNITS

Direct Current

600 KW Crocker-Wheeler, 250 volts, 300 RPM generator direct connected to Ames vertical Unaflow non-condensing engine.

125 KW 125 volt, 250 RPM generator direct connected to 18" x 16" Elliott engine, 100 lb. pressure, 10 lb. back pressure, complete with switchboard.

75 KW 125 volt, 1800 RPM Westinghouse non-condensing turbine-generator unit.

75 KW 125 volt, 2400 RPM Allis Chalmers Terry non-condensing turbine-generator unit.

15 KW (3) Crocker-Wheeler, 125 volts, 410 RPM generators each direct connected to an American Blower vertical engine.

FREQUENCY CHANGER SETS

750 KVA Westinghouse, 3-phase, 60 cycle, 2300 volts alternating current generator direct connected to 910 HP, 3 phase, 25 cycle, 2300 volts, 300 RPM synchronous motor.

1200 KVA General Electric, 3 phase, 60 cycle, 2400 volts alternating current generator direct connecting to 1700 HP, 3 phase, 25 cycle, 2300 volt, 300 RPM synchronous motor.

Utilities Electrical Machinery Corporation

600 NATIONAL CITY BANK BLDG.
CLEVELAND 14, OHIO

WIRE OR PHONE
LONG DISTANCE 422

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You know that all sales-talk re. "rapid delivery" and so forth means nothing unless the equipment you buy is RELIABLE. HEMPHILL is headed by graduate ELECTRICAL ENGINEERS who advise you as to SELECTION, supervise RECONDITIONING and check closely on test results. The fact that we ourselves BUY or acquire control of the equipment we offer you shows that it is a GOOD investment in the first place.

The Army Calls it "Logistics" We call it

RAPID DELIVERY

The location of the Hemphill Warehouse and Shops, and our handling and shipping facilities insures rapid deliveries by rail, truck or water.

The Hemphill SEAL OF QUALITY GUARANTEES ENGINEERED RECONDITIONING

MOTORS—3 PHASE 60 CYCLE

1—500 HP, 900 RPM, Lincoln, 440 volt, slip ring.
1—400 HP, 1200 RPM, 220 volt, Westinghouse squirrel cage.
1—350 HP, 300 RPM, 440 volt, General Electric slip ring.
2—225 H.P. 1200 RPM, 220 volt, General Electric, squirrel cage.
1—200 HP, 600 RPM, 2200 volt, G.E. sl. rg.
1—150 HP, 1800 RPM, 440 volt, General Electric, squirrel cage.
1—150 HP, 400 RPM, 440 volt, General Electric squirrel cage.
1—125 HP, 1800 RPM, 2200 volt, Continental, squirrel cage.
3—100 HP, 720 RPM, 440 volt, G.E., sl. rg.
1—100 HP, 600 RPM, 440 volt, G.E., sl. rg.
2—100 HP, 450 RPM, 440 volt G.E., sq. cg.
1— 90 HP, RPM, 550 volt, Cr. Whir., sq. cg.
1— 75 HP, 1200 RPM, 440 volt, G.E., slip ring.
1— 75 HP, 900 RPM, 4000 volt, Elec. Mach. syn.
1— 75 HP, 720 RPM, 440 volt, Westghse, slip ring.
1— 75 HP, 1200 RPM, G.E., sl. rg.
2— 75 HP, 900 RPM, G.E., sl. rg.
1— 60 HP, 1200 RPM, 220 volt, General Electric, slip ring.
1— 50 HP, 900 RPM, 440 volt, G.E., sl. rg.
1— 50 HP, 900 RPM, 440 volt, G.E., sq. cg.

MOTORS—D. C. 230 VOLTS

2—450 HP, G.E., 440 RPM, Type MPL Form 1-F.
1—250 HP, 760 RPM, Electro Dynamic.
2—125 HP, 1170 RPM, G.E.
1—100 HP, 625 RPM, G.E.
1— 80 HP, Crocker-Wheeler, 600 RPM, Type CMC.
1— 75 HP, G.E., 575 RPM, Type C, Sprague; with spare armature.
8—50 HP, Crocker-Wheeler, 700 RPM, Type CM.

MOTORS—D.C. 230 VOLTS (Con't.)

1—50 HP, 700 RPM, Crocker-Wheeler.
1—30 HP, 750 RPM, G.E., Type RC.
1—30 HP, G.E., 750 RPM, Type RC-14, Form A.
1—30 HP, G.E., 1100 RPM, Type RC-31B, Form A-21.
1—35 HP, G.E., 650 RPM, Type RC-15.
1—30 HP, G.E., 625 RPM, Type C.
1—25 HP, Westghse., 600 RPM, Type SK.
2—25 HP, G.E., 775 RPM, Type RC-13.
1—20 HP, G.E., 800 RPM, Type RC-13, Form A.
1—15 HP, G.E., 800 RPM, Type RC-11.

MOTORS—VARIABLE SPEED 230 VOLTS

1—90 HP, 470/940 RPM, General Electric.
1—75 HP, 525/1575 RPM, Electro Dynamic.
1—60 HP, 500/1000 RPM, Diehl.
1—30 HP, 225/900 RPM, Crocker-Wheeler.
1—30 HP, 400/1200 RPM, General Electric.
1—25 HP, Westinghouse, 650/2200 RPM, Type SK-110L.
2—25 HP, 300/900 RPM, Electro Dynamic.
1—15 HP, 300/1200 RPM, G.E.
1—18/18 HP, 350/1200 RPM, Electro Dynamic.
3—11½ HP, 500/1500 RPM, Westinghouse.
1—10 HP, 400/1600 RPM, Westinghouse.
1— 5 HP, 600/1200 RPM, General Electric.
1— 5 HP, 450/1800 RPM, Crocker Wheeler.
1— 5 HP, 400/1600 RPM, Diehl.
1— 5 HP, 225/900 RPM, Electro Dynamic.

MOTOR GENERATOR SETS

1—150 KW, 125 volt, Westinghouse, squirrel cage.
1— 75 KW, 125 volt, General Electric, squirrel cage.
1— 65 KW, 125 volt, Westinghouse, squirrel cage.
1— 20 KW, 600 volt, General Electric, squirrel cage induction motor.
2— 15 KW, 250 volt, General Electric, squirrel cage.

TURBO GENERATORS

600 KW, Terry dual bleeder condensing Turbine only.
1—375 KVA, Westghse., non-condensing.
1—300 KW. 125/250 General Electric non-condensing.
1—300 KW, G.E., 3 ph., 60 cy., 220 v. con.
1—200 KW, G.E., 3 ph., 60 cy., 220 v. cond.
1— 30 KW, 135 volt, Allis Chalmers non-condenser.

ALTERNATORS

1—625 KVA, 3600 RPM, 600 volt, G.E.
1—250 KVA, 720 RPM, 2300 volt, G.E.
1—200 KVA, 3600 RPM, 240 volt, Allis-Chal.
1—62½ KVA, 3600 RPM, 220 volt, Allis-Chal.

TRANSFORMERS

2—400 KVA, G.E., 4156-250/480 v., Scott taps.
3—300 KVA, Pittsburgh, 7800/440 volts.
3—150 KVA, G.E., 33000/2300/4000 Y.
2—100 KVA, General Electric 2200/220/440 volt.
3—100 KVA, Westinghouse, 11,430/250 volts.
3—100 KVA, Westinghouse, 13200/250 volts.
3— 75 KVA, Westinghouse, 2200/220/110 volts.
3— 75 KVA, G.E., 13,500-750/440 volts.
1— 75 KVA, G.E., 3 phase, 4156Y—120/208Y.
2— 50 KVA, Pbgh., 7500/15000 volts-110/220 volts.
2— 15 KVA, G.E., 2300-115/230 volts.
2—100 KVA, G.E., 2400/240/480.

GASOLINE DRIVEN D.C. GENERATOR SETS

2—25 KW, 125 volt.
1—30 KW, 125 volt.

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ONLY PARTIAL LIST

TRANSFORMERS

1—200 KVA GE, type H.K. 2300/115/230 volts, 1 PH. 60 cy.
2—200 KVA GE, type H Form VD 4800/2400/480 volts, 1 PH. 25 cy.
1—100 KVA GE, type H Form KDD 11000/2600 volt, 1 PH, 60 cy.
2—75 KVA West. type S.K. 1 ph. 25 cy. 60000 volts Prim—6900/2300 volts secondary.
3—75 KVA Gen. Elect. K.S. 1 ph. 60 cy. 2300/115/230 volts.

OTHER SIZES VOLTAGE AND CYCLES AVAILABLE

ALTERNATORS

240 KW, 8 PF Electric Machinery, 4600 volts, 60 cycle, 3 phase, 450 R.P.M. with direct connected exciter.
200 KW. Westh. Unity Power Factor, 3 PH, 60 cyc. 220/440 900 R.P.M. with direct connected exciter.
150 KVA Westinghouse, 3 phase, 60 cycle, 2300 volts, 600 R.P.M. Revolving field with direct connected exciter.
150 KVA Gen. Elec. Type ATB form D, 60, 3 ph., 220/440 600 with Rev. Field. and built in Exc.

MOTOR GENERATOR SETS

Western Elect. 1000 Amps—40 volts direct con. to either AC or DC 580 RPM Motor.

FREQUENCY CHANGERS

30 KVA, Gen. Elect. type I.T.T. frame 526 P.F. 08—220/440 volts 3 Ph. 60 cy. to 240 volts 120 cycle Motor KT frame 526—3 Ph. 60 cy. 220/440 volts 1800 RPM.

ALL SIZES VOLTAGES AND CYCLES

3 ph. 25 cy. Motors

H.P.	Make		Type	Speed	Volt
350	Gen. Elec.	Sl. Rg. 3 Brg	I	375	400
200	Lincoln	S. R.	I. X. W.	500	440
100	West.	Syn. Stator and Rotor	H.R.	300	2200
100	Wagner	Sl. Rg.	BR	750	220/440
70	Gen. Elec.	Syn. Stator and Rotor	ATI	167	2200

3 ph. 60 cy. A. C. Motors

H.P.	Make		Type	Speed	Volts
200	West.	Syn.-Dir. Con. Ex.	P. F. 08	900	220/440
200	Gen. Elec.	Syn.	ATI	514	4000/2300
200	Weghse.	Syn.	Dir. Con. Exc.	600	2300
150	Gen. Elec.	Syn. Stator and Rotor	ATI	400	2200
25	Gen. Elec.	Sq. Cg.	I. K. Vert.	720	220

230 Volt D. C. Motors

H.P.	Make	Type	Speed
75	Crocker Wh.	CCM25JA	700
60	Sprague	D — Comp. Wound	625
40	Fair. Morse	Ball BRG. Vert. Comp.	1740

125 Volt D. C. Motors

H.P.	Make	Type	Speed
60	Allis Chalmers	FB131-Comp. B. B. Pipe Vent.	1755

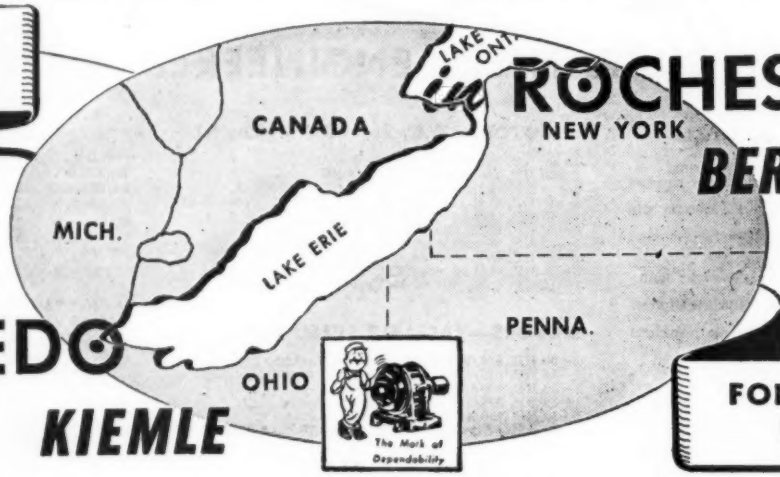
550 Volt D. C. Motors

H.P.	Make	Type	Speed
35	West.	SK 150 Shunt Int.	850

D. C. GENERATORS

150 KW Western Elec. 3 brg. 3 wire, 115/230 V. 600 R.P.M.
50 KW—Northern—Comp. 110 V.—700 R.P.M.

OVER 10,000 STOCK ITEMS



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FOR IMMEDIATE DELIVERY

TRANSFORMERS

3—500 KVA, GE, type H, form VD525 19100-22000/40000Y to 2300 1 phase 25 cycle.
1—350 KVA, GE, type H-K.D.D. 2300/460—1 PH, 60 Cy.
3— 50 KVA Pittsburgh 60 cycle, 1 Ph, 440/110/220 Volts.

OTHER SIZES, VOLTAGE AND CYCLES AVAILABLE

ALTERNATORS

10 K.W. Gen. Elect. 1 Ph. 60 Cy. 220 Volts—1800 R.P.M.

WEST. D.C.—VARIABLE SPEED MOTORS

10—10 H.P. Type S.K. 230 V. 500/1500 R.P.M. with Automatic Dynamic Braking Starters and Field Rheos.

SYNCHRONOUS—CONVERTER

300 KW Gen. Elect. Synchronous Converter, 6 Phase, type HCC form J, 25 cycle 750 speed with transformers for 2300 volts to 230 volts D.C.

3 ph. 60 cy. A. C. Motors

H.P.	Make		Type	Speed	Volts
500	Electric Mach.	Syn.	Stator and Rotor	257	440
200	Weghse.	Sl. Rg.	CW	600	220/440
150	Gen. Elec.	S. R.	I. M.	400	440
150	Gen. Elec.	Sq. Cg.	I.K.	600	2300
100	Gen. Elec.	S. C.	K.T.	720	440
100	Lincoln		M	1150	440
100	Gen. Elec.	R	MT.	600	440

3 ph. 25 cy. Motors

H.P.	Make		Type	Speed	Volts
150	Gen. Elec.	S. R.	IM	500	440
100	Allis Ch.	S. R.		750	440
75	Gen. Elec.	Var.	BTA	375/750	440
75	Gen. Elec.	S. R.	I. M. 17B	160	440
75	Gen. Elec.	Sl. Rg.	I. M.	750	220/440

230 Volt D. C. Motors

H.P.	Make	Type	Speed
150	West.	SK 180L Comp. Wd. Int.	1150
100	Northwestern	K30 Comp. Inter.	1750
60	Gen. Elec.	C-Shunt Wd	600
50	Crocker Wheeler	CM	625

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Put all idle equipment to work. Send your list for prompt action. WRITE OR WIRE YOUR INQUIRIES

Above KIEMLE OFFERS

"BIG STUFF" *is no problem to* BELYEA

In the Belyea Shops we have facilities to dismantle, re-nu-build, test and ship the biggest type of electric power equipment (as well as the smallest). It is facilities such as ours (the result of 37 years service) that materially lower the cost of rebuilding, testing and handling. Thus the price you pay for GUARANTEED Belyea Re-Nu-Built equipment always represents the utmost value for every dollar invested.

3—1667 K.V.A. PITTSBURGH TRANSFORMERS 13200 to 2300 volt, 1 phase, 60 cycle, just recently shipped from Jersey City to customer. A duplicate bank is still available here.

Part list of Belyea Equipment—Successful Operation Guaranteed

MOTOR GENERATOR SETS

3 Phase 60 Cycle

1—1500 KW G.E., 250/275 V. D.C. to 2100 H.P., 2300 V.
1—500 KVA—300 KW—220/440 V. A.C. Gen. to 500 H.P.—250 V. D.C. Motor.
1—500 KW G.E., 600 V. D.C. to 700 H.P. 13200/6600 V.
1—288 KVA Whse., 440 V. A.C. Gen. DC to 304 H.P. —115 V. DC Motor.
1—240 KW Whse., 125 V. DC Gen. DC to 360 HP —440 V.
1—200 KW G.E., 125 V. D.C. to 300 KVA, 440 V. Syn. Motor with exciter.
1—75 KW G.E., 125 V. D.C. to 120 H.P., sq. cg., 2300/4000 V.
1—50 KW G.E., CD 125 V. D.C. to 75 H.P., sq. cg., 2300/4000 V.
1—46 KW Al. Ch. Balancing Set 125/250 V.
1—25 KW GE 250 V. D.C. to 40 HP KT Sq. Cg. 220/440 Volt.

3 Phase 25 Cycle

1—25 KW G.E., 125 V. D.C. to 35 H.P., 360 V. Motor.
1—75 KW Whse., 125 V. D.C. to 110 H.P., 440 V. Motor.
1—250 KW G.E., 250 V. D.C. to 285 KVA, 6600 V. Motor.

TRANSFORMERS—POWER AND DISTRIBUTION

60 CYCLE (Unless Otherwise Noted)

Qu.	KVA	Make	Ph.	Type	Voltages
3	1667	Pitts.	1	OISC	13200x2300
1	1050	G.E.	3	WCTH	11000x445/222½
4	525	G.E.	1	HJ	2300x445
2	450	G.E.	3	HTDD	6600x240
4	500	Pitts.	1	OISC	13200x2300
2	333	Pitts.	1	OISC	2400x220
3	333	Maloney	1	C	22000/11000x2300/575
2	333	Whse.	1	OISC	2300/460
1	300	Pitts.	3	OISC	4150x208/120
3	200	G.E.	1	HLLD	27600x115/460
2	200	G.E.	1	HKDD	13800x220/440
1	200	Whse.	1	SK	6600x220/440
3	200	G.E.	1	HJ	2300x408/204
1	200	G.E.	2-3	Auto	2500x2500
1	200	G.E.	1	H	2300x115x230
3	150	Maloney	1	C	2300x220/440
7	125	Maloney	1	C	2300x220/440
3	100	G.E.	1	HJDD	13200x445/226
3	160	Whse.	1	OISC	13200x250
1	100	Whse.	1	OISC	11430x250
2	100	G.E.	1	A	2200x120/240
1	100	G.E.	1	HKS	2300x220/440

A.C. MOTORS

3 Phase 60 Cycle

SLIP RING

Qu.	HP	Make	Volts	RPM	Desc.
1	100	G.E.	440	575	IM
1	100	G.E.	550	685	MTC-5552
1	100	G.E.	550	720	IM
1	100	G.E.	2200	1750	IM
1	100	G.E.	220	1750	IM
1	200	G.E.	440	450	IM (3 Brg.)
1	200	Whse.	440	580	CW
1	200	Al. Ch.	440	505	
1	250	G.E.	4000	257	MT-424Y
1	250	Al. Ch.	440	505	ANY
1	350	G.E.	4000/2200	253	MT-442Y
1	350	G.E.	550	390	MT-412Y
1	400	G.E.	2200	252	IP
1	400	A.-C.	2300	505	ANY
1	450	Whse.	2200	875	CW
1	500	Al. Ch.	2200	590	ANY-36
1	600	Cr. Wh.	2200	507	131-AQ
1	800	A.-C.	400	885	ANY
1	1200	C. W.	2300	237	801Q
1	2500	G.E.	6600	253	MT

SQUIRREL CAGE

Qu.	HP	Make	Volts	RPM	Desc.
1	150	Whse.	550	400	CS-594A
2	175/112	G.E.	440	990/720	IK
1	200	G.E.	440	580	IK
2	200	G.E.	2300	1175	11C
1	200	G.E.	2200	490	IK
1	200	G.E.	550	580	IK
1	300	G.E.	440	900	IK
1	300	Whse.	550	580	CS

SYNCHRONOUS

Qu.	HP	Make	Volts	RPM	Desc.
1	75	G.E.	220	600	TS 7556
1	600	Al. Ch.	2300	720	
2	2100	G.E.	2200/4400	514	ATI

SYNCHRONOUS CONDENSERS

Qu.	Kva.	Make	Volts	Speed	Desc.
1	750	G.E.	220/440	900	ATI
1	2000	Whse.	2300	720	
2	2100	G.E.	2300/4600	514	ATI
1	3000	Al. Ch.	2300	900	
1	5000	Whse.	2300/4000	900	

3 Phase 25 Cycle

1	75	Al. Ch.	440	750	ANY
1	150	G.E.	440	500	IM
1	200	G.E.	440	242	Sl. Rg.
1	300	G.E.	440	290	Sl. Rg.
1	390	G.E.	6600	750	ATI
1	1400	G.E.	2300	500	ATI

ROTARY CONVERTERS

3 Phase 60 Cycle

Qu.	KW	Make	Speed	Dc V.	Trans. V.
1	1500	Whse.	720	600	2300
1	1500	Whse.	600	600	11500
1	1250	G.E.	720	250	2300
1	1000	Whse.	720	250	22000
1	1000	G.E.	900	600	13200
1	1000	Whse.	900	600	11000
2	750	G.E.	1200	600	2300
1	750	Whse.	720	250	6600/2300
1	500	Whse.	1200	600	13200/2300
2	375	G.E.	1200	250	6600/2300
2	300	G.E.	1200	600	2300
1	300	Al. Ch.	1200	250	2400

3 Phase, 25 Cycle Booster Type

2	1500	G.E.	500/225/275/13200/6600
1	500	G.E.	750/225/275/13200/6600

All units can be furnished with AC and DC controls

D.C. MOTORS

Qu.	HP	Make	Type	Volts	Speed
2	1250	G.E.	MPC	500	180
1	1200	Whse.	Int.	600	600/720
1	1200	G.E.	MPC	600	450
1	800	G.E.	MPC	550	600
2	625	G.E.	MPC	500	130
1	500	Whse.	Int.	250	250/720
1	500	G.E.	MPC	230	800
1	350	G.E.	MPC	230	450
1	300	G.E.	MPC	230	275/550
1	250	Al. Ch.		230	525
1	200	Whse.	SK	230	400
3	135/175	G.E.	MCF	230	450/1050
1	150	G.E.	MPC	230	250/450
2	140	Cr. Wh.	CMC-65H	550	1200
2	125	G.E.	CO-1832	230	625
1	100/150	Whse.	SK-200	550	600
1	100	G.E.	LC-50	230	1200
1	100	Whse.	SK-180	230	600
1	50/100	G.E.	MPC	230	225/450
1	75	G.E.	C	230	500/1000
1	60	El. Dy.	258	230	525/1050
1	50/60	Cr. Wh.	CMC-65H	230	500/1000
1	50	G.E.	RC-19	230	400/1200
1	50	Cr. Wh.	CMC-80H	230	380/750
1	15/50	Cr. Wh.	CMC-81H	230	300/900
2	40/50	G.E.(new)	CD-1238S	230	400/1600
2	40	El. Dy.	305	230	300/900
1	40	G.E.	CD-123	230	500/1500
4	25/30	G.E.(new)	CD-1136S	230	400/1600

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O'BRIEN has in stock for immediate shipment a large variety of thoroughly rebuilt air compressors up to 2,500 CFM capacity. These are complete units consisting of motors, compressors, aftercoolers and air receivers.

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We've recently supplied a number of war plants almost overnight to help meet accelerated military demands—saving them 6 to 8 months required to get new compressors. If you need *dependable* air compressing equipment in a hurry your best bet is O'BRIEN, the single time- and money-saving source. Wire or phone today for prices and delivery on your specific needs.

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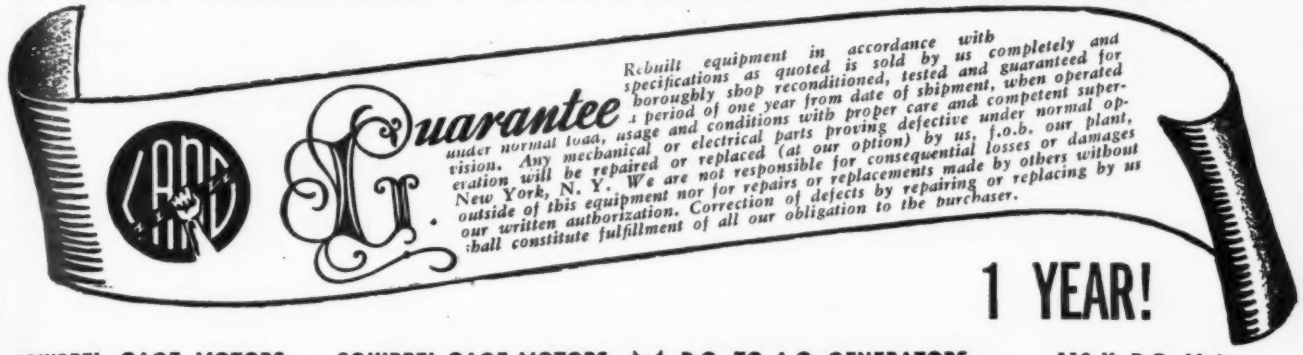
AFFILIATED WITH

SOC EXPANSÃO INDUSTRIAL SUL AMERICANA LTDA

RUA CANDELARIA, 9 RIO DE JANEIRO — BRASIL

DEPENDABLE ELECTRICAL EQUIPMENT


LAND
Guarantee
Rebuilt equipment in accordance with specifications as quoted is sold by us completely and thoroughly shop reconditioned, tested and guaranteed for a period of one year from date of shipment, when operated under normal load, usage and conditions with proper care and competent supervision. Any mechanical or electrical parts proving defective under normal operation will be repaired or replaced (at our option) by us, f.o.b. our plant, New York, N. Y. We are not responsible for consequential losses or damages outside of this equipment nor for repairs or replacements made by others without our written authorization. Correction of defects by repairing or replacing by us shall constitute fulfillment of all our obligation to the purchaser.
1 YEAR!

SQUIRREL CAGE MOTORS
3 ph. 60 Cy.

Qu.	HP	Make	Type	Speed
1	200	G.E. 440 v.	IK	600
1	147	West 25 cy.	CS	715
1	100	Al. Ch.		690
1	100	West.	CS	690
2	100	G.E. 440 v.	PTA56	375/750
1	85	G.E. 2300 v.	PT529	3500
1	75	El. Dy.	KNX505	1750
1	75	Burke		1150
1	50	G.E.	KT537	1750
1	50	Star	A75	1750
1	50	West.	CCL	1150
1	50	Al. Ch.		865
1	50	Cr. Wh.		865
1	50	Burke		690
1	50	West.	CS	580
2	45	W.E.		150/900
1	40	West.	CS	1760
4	40	El. Dy.	DNX444	1760
1	40	G.E.	KT	1150
1	40	Lincoln		1150
1	35	Wagner		850
1	35	West.	CS	690
1	30	U. S. Vert.	CPU907	3450
1	30	A-C		1150
1	30	Diehl		860
1	30	Cr. Wh.		870
1	30	Al. Ch.		870
1	30	G.E.	KT342	690
1	30	West.	CCL	690
1	30	G.E.	IK	514
1	25	Triumph		1750
1	25	G.E.	KT302	1750
1	25	Wagner 220v.	F-W	1200
1	25	Al. Ch.		1150
1	25	West.	CS	1150
1	25	El. Dy.	KMQ444	865
2	25	G.E.	IK	865
2	25	Diehl	I8167	865
1	25	West.	MS	860
1	25	Wagner 440v.	P-W	720
125/12½		G.E.	445	840/405
1	20	West.	CS365	3500
1	20	G.E.	PT312	1740
1	20	G.E. Vert.	PT501	1750
9	20	El. Dy.	KNX364	1750
1	20	F.M.	KMV12D	1150
2	20	G.E. Vert.	KT512	1150
1	20	Cr. Wh.		1150
1	20	F.&M.		1160
2	20	West.	CS	1160
1	20	G.E.	KT332	1160
2	20	Al. Ch.		860
1	20	F.M.		860
1	20	Diehl		860
1	20	West.	CS566	870
1	20	G.E.	KT326	870
1	20	G.E.	IK	690
1	20	West.	CS584	690
1	20	West.	CCL	690
1	15	West.	CS324	3500
2	15	G.E.	KF751	3400
1	15	Burke		1750
1	15	Wagner 220v.	P-W	1800
1	15	El. Dy.	326	1750
1	15	Lincoln		1150
1	15	G.E. Vert.	KT502	1150
1	15	West.	CCL	1150
3	15	West.	MS	1150
1	15	West.	CS	1150
1	15	G.E. Vert.	IK	860
1	15	West.	CS	860
1	15	Wagner 440v.	F-W	720
1	15	G.E.	IK	720
1	15	West.	CS504	415
3	10	G.E.	KT	3600
1	10	Cr. Wh.	Gr.Hd.	400
12	15	West.	CS 445	600/900 1200/1800

SQUIRREL CAGE MOTORS
2 ph. 60 cy. type

Qu.	HP	Make	Type	Speed
1	75	G.E.	IQ	1750
1	70	G.E. Synch.	AQI	1200
1	50	Lincoln		870
1	50	G.E.	IQ	870
1	40	Al. Ch.		870
1	40	F-M		870
1	35	Al. Ch.		870
1	30	West.	CCL	1150
1	25	G.E.	KQ312	1750
1	25	G.E.	ICL	1150
1	25	West.	CCL	1150
1	25	Burke		900
1	20	West.	CS	1160
1	15	F-M		1750
1	15	G.E.	KQ502	1150
1	15	West.	CS4	1150
1	15	G.E.	IQ	720

SLIP RING MOTORS
2 & 3 ph. 60 cy.

Qu.	HP	Make	Type	Speed
1	450	G.E.	MT412	506
1	250	G.E.	IM	580
1	150	El. Dy.	New	1770
1	100	G.E.	MTC5546	800
1	100	G.E.	IM	900
1	100	G.E.	IM	690
1	100	F-M	FA	690
1	75	G.E.	IM	1160
1	75	West.	RF	1160
1	75	Al. Ch.		865
1	75	Al. Ch.	ANY	575
1	65	G.E.	MTC552	585
2	60	Otis		1750
1	60	West.	CW648	1150
1	60	West.	CW950A	290
1	50	G.E.	Ig	870
1	50	Wagner		1150
1	40	F-M		870
1	40	West.	CW	870
1	35	Burke		690
1	40	G.E.	MT312	570
1	30	G.E.	MC332	870
2	30	G.E. 220v.	MT542	690
1	25	West.	CW	1160
1	25	Louis Allis		1750
2	25	Al. Ch.	ANY20G	870
1	25	Burke	FMV3	870
1	25	Howell	SFS420	870
1	25	West.	CW748	575
2	15	G.E.	MT502	1150
1	15	West.	CW	870
1	15	Cleveland	MW147	870

A. C. GENERATORS

Qu.	Kw	Make	Voltage	Speed
1	150	G.E.	220/440	600
1	150	Cr. Wh.	220/440	900
1	100	West.	220/440	600
1	35	Allen	220/440	900
1	35	Burke	220/440	720
1	50	Elec. Mchy.	220/440	900
1	25	West. 1 ph.	110/220	1200

A.C. TURBO GENERATOR

625 KVA Westinghouse Geared Turbine, 150 lbs., 35 lbs. back pressure 3 ph. 60 cy. 2400 Volt .8PF also driving

D.C. TO A.C. GENERATORS

1—4 KVA Hertner, 115 v. DC to 115 v. 60 cy. 1 phase

1—7½ KVA Century 115 v. DC to 115 v. 60 cy. 1 phase

1—7½ KVA Elec. Spec. 115 v. DC to 3 ph. 60 cy 440 v.

230 V. D.C. MOTORS

Qu.	HP	Make	Type	Speed
1	350	West.	SK	340/425
1	150	West.	S	600
1	60	G.E.	LC	450/1160
1	60	El. Dy.	258	450/900
1	50	El. Dy.		900
1	50	West.	SK150	550/1100
1	45	Diehl		850
1	40	G.E.	DLC	1050
40	40	Cr. Wh.	CCM	915
1	35	West.	SK	1150
1	35	West.	SK120	975
1	35	G.E.	PLC204	440/880
2	35	West.	SK160	400/600
2	30	G.E.	CD83	3450
1	30	G.E.	RC	1150
1	30	West.	SA	975
1	25	G.E.	RC	1150
1	25	West.	SK	1150
1	25	Diehl	K8	850
1	25	Louis Allis	Encl.	900
1	25	Al. Ch.		850
1	25	El. Dy.		1500
1	25	G.E.	CD113	575
1	20	G.E.	CD83	1200/1600
1	20	R. & M.		1150
1	20	G.E.	RC	1150
1	20	El. Dy.		950
1	20	G.E.	RC	800
1	20	West.	SK110L	750
1	15	Roch.	SV5	3450
3	15	G.E.	RC	1150
2	15	G.E.	CD	1150
1	15	G.E. Vert.	CD	900
1	15	West.	SK	850
1	15	G.E.	RC	850
1	15	West.	SK	600/2500
1	13	Diehl		200/247
1	10	G.E.	RF	450/1800
1	10	G.E.	CD	1150
1	10	West.	SK	400/1200
3	10	G.E.	RC	850
1	10	G.E.	CVC	700
1	10	Diehl		750
1	10	West.	SK	600/1200
1	10	El. Dy.		450/1800
1	10	G.E.	RF	400/1600
2	10	West.	SA	400/1200
1	10	G.E.	RF	450/1800
1	8½	Diehl		900
1	8½	West.	SK	850
1	8½	West.	SK90	350/1400
1	8	G.E.	RLC	500/1500
1	7½	G.E.	RC	1700
1	7½	G.E.	CVC	1525
1	7½	West.	SK	1450
3	7½	G.E.	RC	1150
2	7½	G.E.	RC	1150
1	7½	West.	SK	950
1	7½	Al. Ch.		850
1	7½	G.E.	RC	850
3	7½	G.E.	RF	600/1800
1	7½	El. Dy.		550/1650
1	7½	Watson		525/1150
2	7½	G.E.	RF	450/1800
1	7½	West.	SK	450/1600
1	7½	Al. Ch.		350/1050
1	3	West.	Gr. Hd.	12½

110 V. D.C. Motors

Qu.	HP	Make	Type	Speed
1	90	G.E.	DLC65	900
1	30	G.E.	CD	1150
1	15	EK		1000
1	15	El. Dy.		615/1230
1	10	El. Dy.	3S	1100
1	10	West.	SK	850
1	10	El. Dy.	7½S	425/1275
1	10	Diehl		230
1	7½	Cr. Wh.		900
1	7½	West.	SK	500
1	7½	El. Dy.	5S	450/900
2	7½	El. Dy.	5S	600/1200

D.C. GENERATORS

KW	Make	Volts	Amps	Speed
300	West.	250	1200	900
250	G.E.	125	2200	720
100	West.	250	400	720
100	Al. Ch.	250	400	570
100	G.E.	125	800	1150
50	G.E.	250	200	870
50	G.E.	125	400	1150
45	El. Prd. 6/12		7500/3750	400
40	El. Dy.	250	160	1150
30	Reliance	250	120	1750
30	West.	125	240	1160
30	El. Dy.	600	50	1150
30	Har.	60	500	1150
25	West.	125	200	1150
25	El. Mchy. Syn.	125	200	1200
25	G.E.	250	100	1150
20	G.E.	125	160	1150
20	West.	250	80	1150
15	Burke	125	120	900
15	G.E.	250	60	1150
10	Al. Ch.	125	80	1150
10	G.E.	250	40	1150
7½	West.	250	30	1150
7½	G.E.	125	60	1150
5	G.E.	250	20	1150
5	West.	125	40	1150
5	G.E.	600	9	1750

15—100/125 Amp. 7½ Volt D.C. Generator 3 ph. 60 cy 220/440 Volt Motors.

SPECIAL ELECTRONIC Speed Regulated Motor Drive

300 KW West. SK 250 Volt D.C. Generator 900 RPM. with 350 HP West. SK 250 V. D.C. Motor, double end shaft, speed 0 to 600 RPM. Complete with Pilot Generator, all control and necessary 4 unit Meter Generator exciters.

COOLANT PUMPS

50—New Ruthman (Gusher) Coolant pumps, with ¼ H.P. 3 ph. 60 cy. 220/440 Volt Motors.

800 & 400 Cycle Generators

3—1 KVA Holzer Cabot 3 ph. 60 cy. 220/440 V.
2—1 KVA—800 cycle.

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NEW YORK CITY'S LARGEST STOCK OF ELECTRICAL MACHINERY

L. J. LAND & COMPANY

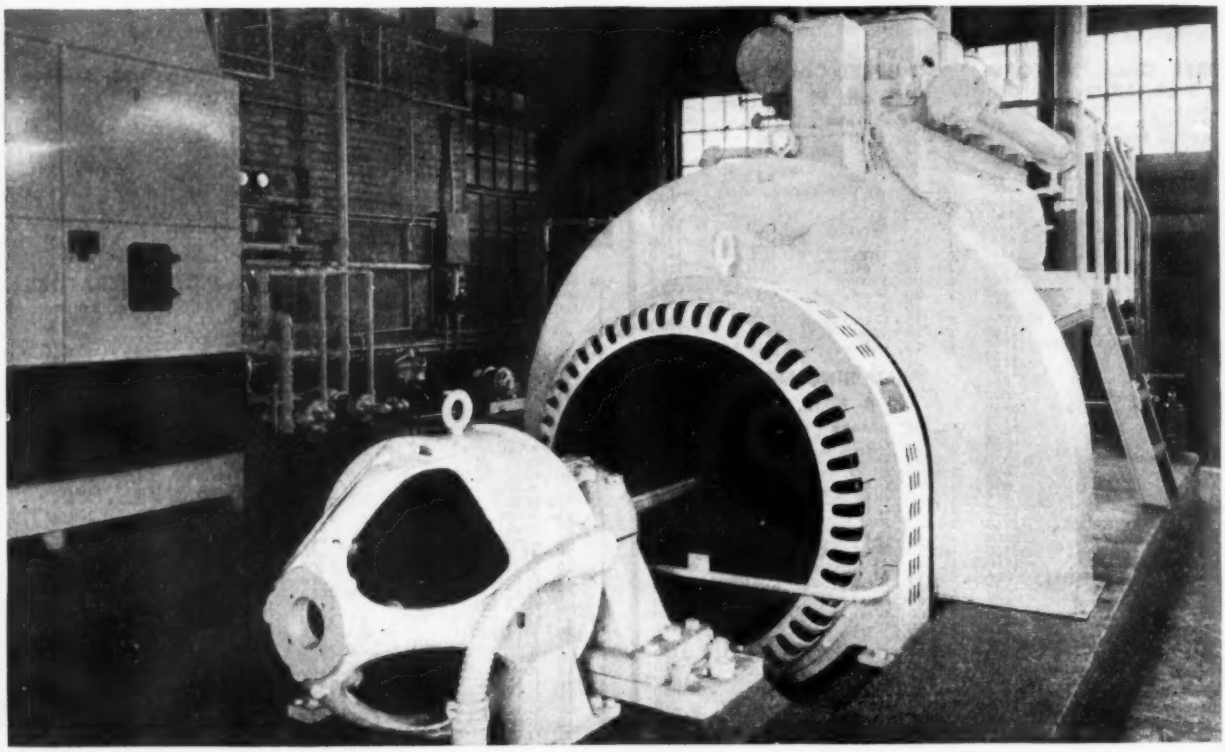
ESTABLISHED 1910

146 GRAND ST., NEW YORK 13, N. Y. CAnal 6-6976

Branch Offices:
10th & Exeter Streets, Reading, Penna.

1750 H. P. DIESEL PLANT

3 McINTOSH & SEYMOUR GENERATOR SETS AVAILABLE TODAY—(SELL ONE OR ALL)



375 HP Unit and Auxiliaries New 1938—July 1945 photograph

This modern plant consists of the following units:

1—1000 H.P. 8-B-32 8 Cylinder 16 x 20—360 RPM DC to 1000 KVA 3/60/2300
1— 375 H.P. 5-B-25 5 Cylinder 12½ x 18—360 RPM DC to 312 KVA 3/60/2300
1— 375 H.P. 3-B-32 3 Cylinder 16 x 20—360 RPM DC to 372 KVA 3/60/2300

Voltage will be corrected to your requirements

Complete auxiliary equipment includes closed circulating jacket water cooling system employing Buffalo evaporative cooler with circulating pumps and blowers using sweet water in the engine jackets to prevent scale accumulation—complete air starting equipment—fuel oil transfer systems—Lube oil circulating pumps—complete switchboard system consisting of 3 generator panels, one exciter panel—one voltage regulator panel—with necessary meters, main oil switches and synchronizing devices for operation of these units in parallel.

REBUILT-GUARANTEED

Running inspection available by Appointment

ROBERT SCHOONMAKER

Port Washington, Long Island, N.Y.

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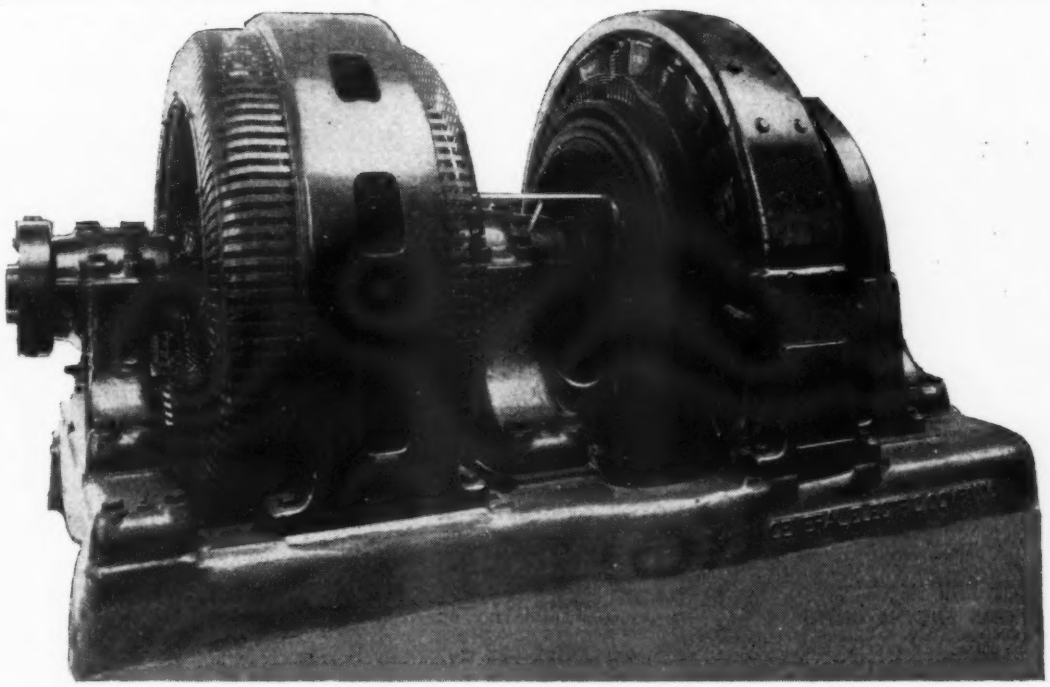
ELECTRICAL POWER MACHINERY



1000 KW GENERAL ELECTRIC MOTOR GENERATOR SET

1000 KW General Electric compound interpole direct current generator, type MPC, form L, 250 volts, 514 RPM, mounted on common cast iron sub-base and direct connected to 1400 HP 80% PF 1400 KVA 40° General Electric synchronous motor, type ATI, form C, 3 phase 60 cycle 2200 volts, 514 RPM. Complete with direct current and alternating current switchboard panels with instruments and starting equipment

STEAM TURBINE GENERATORS

3 phase 60 cycle

7500 KVA General Electric condensing turbine generator unit, 2300/4000 volts, 250# steam pressure, with surface condenser

2500 KVA Westinghouse condensing turbine generator unit, 2300 volts, 200# steam pressure, with surface condenser

1875 KVA Westinghouse automatic extraction type condensing turbine generator unit, 480 volts, 175-200# steam pressure, 0-20 lbs. extraction pressure, with surface condenser

1563 KVA Allis Chalmers-Kerr non-condensing turbine generator unit, 2300 volts, 150-200# steam pressure, 0-15# back pressure

937 KVA General Electric condensing turbine generator unit, 2300 volts, 150# steam pressure, with surface condenser

STEAM ENGINE GENERATORS

3 phase 60 cycle

500 KVA Westinghouse generator, 2300 volts, direct connected to Nordberg uniflow engine, 175# steam pressure, 5# back pressure

480 KVA General Electric generator, 480 volts, direct connected to Skinner uniflow engine, 150# steam pressure, 5# back pressure

312 KVA General Electric generator, 480 volts, direct connected to Skinner uniflow engine, 125# steam pressure, 5# back pressure

260 KVA Western Electric generator, 240 volts, direct connected to Skinner uniflow engine, 175# steam pressure, 5# back pressure

156 KVA General Electric generator, 2300 volts, direct connected to Skinner uniflow engine, 150# steam pressure, 5# back pressure

DIESEL ENGINE GENERATORS

3 phase 60 cycle

300 KVA Fairbanks Morse generator, 240/2400 volts, direct connected to Fairbanks Morse Diesel engine, 257 RPM

185 KVA Fairbanks Morse generator, 2400 volts, direct connected to Fairbanks Morse Diesel engine, 300 RPM

STEAM ENGINE GENERATOR

250 volts Direct Current

600 KW Crocker Wheeler generator, 250 volts, direct connected to Skinner vertical uniflow engine, 150# steam pressure, 5# back pressure

ROTARY CONVERTERS

250 volts Direct Current

2250 KW (2) Westinghouse self-starting synchronous rotary converters, 230/300 volts, direct current, 450 RPM, with 3 phase, 60 cycle, 13200 volt transformers and switching equipment

INTERNATIONAL POWER MACHINERY CO.

UNION COMMERCE BLDG. **Telephone: MAin 9514** **CLEVELAND 14, OHIO**

THE PICK OF POWER EQUIPMENT

TURBINE UNITS—60 Cy.
1—15300 KVA Westinghouse Cond.
1— 7500 KVA General Electric Cond.
1— 6250 KVA General Electric Cond.
1— 5000 KVA General Electric Cond.
1— 4000 KW General Electric Cond.
1— 3125 KVA Westinghouse Cond.
1— 3125 KVA General Electric Extrac.
1— 2500 KVA General Electric Cond.
1— 1563 KVA General Electric Cond.
1— 1563 KVA Westinghouse Extrac.
1— 750 KVA General Electric Cond.
1— 625 KVA General Electric Cond.
1— 625 KVA General Electric Non-C.
1— 250 KVA Westinghouse Non-C.
1— 125 KVA Westinghouse Non-C.

D. C. TURBO UNITS
1—1500 KW General Electric 250 V.
2—1000 KW General Electric 250 V.
1— 125 KW General Electric 125 V.
1— 75 KW General Electric 125 V.
1— 25 KW Westinghouse 125 V.

STEAM ENGINE UNITS—60 Cy.
1—1067 KVA Nordberg Uniflow
1— 375 KVA Nordberg Uniflow
1— 375 KVA Skinner Uniflow
1— 375 KVA Harrisburg Uniflow
1— 350 KVA Ames Uniflow
1— 325 KVA Skinner Uniflow
1— 300 KVA Hamilton 4-valve
1— 210 KVA Skinner Uniflow
1— 150 KVA Skinner Uniflow
1— 94 KVA Ridgway 4-valve
1— 93.8 KVA Skinner Uniflow

D. C. STEAM ENGINE UNITS
1—500 KW Ames Uniflow 250 V.
1—400 KW Ridgway 4-valve 275 V.
1—350 KW Ridgway Uniflow 250 V.
1—300 KW Skinner Uniflow 275 V.
1—250 KW Ames Uniflow 250 V.
1—150 KW Ridgway 4-valve 125/250 V.
1—125 KW Ridgway 4-valve 250 V. 3-wire

OIL & GAS ENGINE UNITS
1—625 HP Worthington, 240 V. 60 cy. gen.
1—520 HP Busch Sulzer, 2400 V. 60 cy. gen.
1—450 HP M.A.N., 2300 V. 60 cy. gen.
1—440 HP Nordberg, 250 V. DC gen.
1—375 HP Worthington, 240 V. 60 cy. gen.
1—375 HP McInt. & Sey., 240 V. 60 cy. gen.
1—320 HP Winton, 240 V. 60 cy. gen.
1—300 HP McInt. & Sey., 480 V. 60 cy. gen.
1—175 HP Sterling (gas), 480 V. 60 cy. gen.
2—125 HP Winton, 240 V. 60 cy. gen.

WATER TUBE BOILERS
1—880 HP B. & W. 250-lb., Stoker
1—612 HP Stirling 200-lb.
2—560 HP Erie City 460-lb.
1—484 HP Springfield 200-lb., Oil Fired
2—481 HP Springfield 225-lb., Pulverizer
2—407 HP Wickes 160-lb., Stokers
2—405 HP Erie City 160-lb., Stokers
2—312 HP Stirling 160-lb., Stokers
2—300 HP Heine 200-lb.
2—300 HP B. & W. 160-lb.

SYNCHRONOUS MOTORS
1—1700 HP West., 60 cy. 2300 V. 300 RPM
1— 600 HP G.E. 60 cy. 2200 V. 600 RPM
1— 375 HP G.E. 60 cy. 2300 V. 1800 RPM
1— 200 HP Ideal 60 cy. 4000 V. 514 RPM
1— 175 HP West. 60 cy. 4000 V. 514 RPM
1— 150 HP West. 60 cy. 2200 V. 600 RPM
1— 100 HP G.E. 60 cy. 2300 V. 240 RPM (Super)
1— 100 HP G.E. 60 cy. 4000 V. 1800 RPM

INDUCTION MOTORS—60 Cy.
4—3500 HP G.E. slip ring 2300 V. 120 RPM
1—2500 HP G.E. slip ring 6600 V. 253 RPM
1—1000 HP West. slip ring 2200 V. 360 RPM
2— 400 HP G.E. slip ring 3800 V. 1800 RPM
1— 300 HP West. slip ring 440 V. 1200 RPM
2— 250 HP West. slip ring 2300 V. 450 RPM
1— 150 HP G.E. slip ring 440 V. 450 RPM
1— 100 HP G.E. sq. cage 2200 V. 900 RPM
1— 75 HP G.E. sq. cage 440 V. 514 RPM

MOTOR GEN. SETS—60 Cy.
1—1500 KW Allis Chalmers 600 V. DC
1—1000 KW General Electric 600 V. DC
1—1000 KW Westinghouse 250 V. DC
1— 300 KW Westinghouse 600 V. DC
1— 200 KW Westinghouse 250 V. DC
1— 150 KW Westinghouse 250 V. DC
1— 75 KW General Electric 125 V. DC

ROTARIES—60 Cy.
2—2600 KW General Electric 250 V.
2—1700 KW General Electric 250 V.
1—1500 KW Westinghouse 250 V.
2—1000 KW Westinghouse 250 V.
1— 750 KW Westinghouse 225/275 V.
1— 500 KW General Electric 250 V.
2— 500 KW Westinghouse 600 V.

FREQUENCY CHANGERS
2—12500 KW G.E. 60/25 cy. 300 RPM
2— 5000 KVA West. 25/60 cy. 300 RPM
2— 3125 KVA West. 25/62½ cy. 750 RPM
1— 1875 KVA G.E. 25/60 cy. 300 RPM
1— 1250 KVA G.E. 25/60 cy. 300 RPM
1— 750 KVA G.E. 60/25 cy. 300 RPM

TRANSFORMERS—1 Ph. 60 Cy.
2—10000 KVA West. 115,000-6900 V. 3 ph.
4— 500 KVA West. 110,000-2300 V.
3— 4000 KVA West. 83.5/110-19/33 KV
4— 2500 KVA G.E. 63.5/110-19/33 KV
3— 25 KVA Pitts. 66000-25-400/12700 V.
1— 1500 KVA Pitts. 66000-33000 V. 3 ph.
3— 750 KVA Pitts. 66000-33000 V.
3— 600 KVA West. 66000-2300 V.
3— 333 KVA G.E. 66000-480 V.
3— 100 KVA G.E. 66000-6900/11000 V.
3— 1167 KVA G.E. 44000-2300/4000 Y V.
4— 1667 KVA Pitts. 33000-2400 V.
3— 833 KVA Al. Ch. 34460-4800/2400 V.
3— 200 KVA G.E. 33000-2300/4000 Y V.
3— 150 KVA G.E. 22000-2300 V.
3— 75 KVA G.E. 33000-13200/11000 V.
14— 75 KVA G.E. 33000-2400 V. New
40— 50 KVA G.E. 33000-2400 V. New
50— 25 KVA G.E. 33000-2400 V. New
1—15000 KVA Al. Ch. 27880-4560 V. 3 ph.
2—10000 KVA West. 26400-4560 V. 3 ph.
1— 6000 KVA West. 26400-2300 V. 3 ph.
3— 667 KVA Packard 23000-440 V.
4— 400 KVA Pitts. 22000/11000-2200 V.
3— 200 KVA G.E. 22000/230/460 V.
1—10000 KVA West. 13200-4560 V. 3 ph.
1— 3000 KVA Kuhlman 13800-480 V. 3 ph.
3— 1667 KVA Pitts. 13200-2300 V.
4— 1250 KVA Pitts. 13500-230/460 V.
3— 200 KVA G.E. 13200-480 V. Pyranol
7— 667 KVA Maloney 11000-2300 V.
3— 100 KVA G.E. 6900-230/460 V.
3— 75 KVA G.E. 6900-230/460 V.
6— 25 KVA West. 6900-230/460 V.
3— 833 KVA Penn. 4800-240/120 V.
3— 150 KVA G.E. 2400-120/240 V.

OIL CIRCUIT BREAKERS
6— 400 A. 37 KV G.E. FHK0136 Outdoor
2—1000 A. 30 KV Kelman CB76 Outdoor
1— 400 A. 25 KV G.E. FK0136 Outdoor
2— 600 A. 15 KV G.E. FK037 Outdoor
1— 600 A. 15 KV West. O-221 Outdoor
2— 400 A. 15 KV G.E. FHK0136 Outdoor
3— 400 A. 15 KV G.E. FK132B Indoor
2—1200 A. 15 KV G.E. FK132B Indoor
6—1200 A. 4.5 KV Condit D-12 Indoor

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Special Offerings

TURBO-GENERATORS
1—6000 KW. G.E. 2300/4000 V.
1—4000 KW. 2300 V. Cond.
1—2000 KW. 600 V. Cond.
1—1500 KW. 2300 V. Cond.
1—750 KW. 2300 V. Cond.
1—750 KW. 600 V. Cond.
1—500 KW. 440 V. Non C.
1—500 KW. 125 V. D.C.
1—375 KW. 440 V. Cond.
1—200 KW. 2300 V. Cond.
1—120 KW. 440 V. Non. C.

ENGINE GENERATORS
1—168 KW. 550 V.
1—100 KW. 250 V. D.C.
1—600 KW. 2300 V.
1— 75 KW. Uniflow 240 V.

TURBINES ONLY
1—375 H.P. with gears
1—210 H.P. Terry 250#
1—100 H.P. G.E. with gears

BOILERS
1—500 H.P. 200# Oil
2—175 H.P. 200# Oil
2—480 H.P. 225#
1—305 H.P. 185# Stoker
1—200 H.P. 450# Oil
1—150 H.P. 150# H.R.T.

CONDENSERS
1—6000 Sq. Ft. Surface
2—2212 Sq. Ft. Surface
1—1485 Sq. Ft. Surface

AIR COMPRESSORS
1—6700 C.F. 22# Turbine Driven
1—1600 C.F. 50# Steam Driven,
1—860 C.F. 50# Diesel
1—1247 C.F. 55# Motor
1—1214 C.F. 100# Motor Driven
1—600 C.F. 350# Steam Driven
1—386 C.F. 100# Steam Driven

PUMPS
1—3000 GPM 65' Hd Motor
1—1000 GPM Fire Pump Steam
1—750 GPM Fire Pump Steam

Write or wire for additional data and prints.

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3—55/67.5 K.W. Star Ball Bearing Generators D.C. 110/230/250 volt, type S.O. 94, compound wound.

Including fully automatic panel boards, voltage regulator, Motor generator and balancing sets, transfer pumps, etc., also 230 volt set of Philco heavy duty Batteries 420 amps hr., practically new. This is one of the finest and most complete plants offered in some time. May be seen in operation.

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Fairbanks Morse Diesels, 225, 240, 280, 360, 375, 420 HP. Also generators.
Busch Sulzer Diesels, 400, 500, 600 HP.
McIntosh Seymour Diesel: 300 HP.
Boilers: 30 to 100 HP Vertical firetub. 80, 150, 250 HP H.R.T. 125 lb. 250 to 800 HP Water tube types.
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WAGNER

"Certified Rebuilt" ELECTRICAL APPARATUS

M-G SETS

300 KW Gen. Elec. type MPC gen. DC 170 volts 1760 amp. coupled to 450 HP G.E. MPC motor DC 250 V. 1150 RPM (can furnish A.C. drive).

217 KVA Whse. AC gen. 3-60-120/208 V. coupled to 225 HP type SK motor DC 230 V. 1200 RPM, 3 brg. unit, like new, also operates AC to DC, with panels.

100 KW Gen. Elec. 3 brg. unit, type RC gen. DC 125 v. coupled to 150 HP sq. cage 1-K motor 3-60-2200/4000 V.—1200 RPM.

50 KW Cr. Wheeler type CC generator DC 125 V. coupled to 80 HP C-W motor sq. cage 3-60-220/440 V. 1800 RPM.

35 KW Gen. Elec. DLC gen. DC 250 V. to 50 HP AC motor 3-60-220/440 V.

30 KW Gen. Elec. CD 103 gen. DC 60 v. 500 amp. coupled to 45 HP G.E. KT 533 motor 3-60-220/440 v. 1160 RPM, late style 3 brg. unit.

19 KW Gen. Elec. CD95 gen. DC 65 V. 300 amp. to 30 HP G.E. KT motor 3-60-220/440 V.

Others available — special units built to order

D. C. MOTORS

H.P.	Mfr.	Type	Volts	Speed
100	Northw'n	interpole	230	1700
100	Reliance	1050T	230	500/1200
100	Sprague cradle dynamometer		250	1650/2500
75	Fair. Morse	TR	230	525
60	Triumph	interpole	230	900
50	G.E. Sprague	LC	250	700/2000
50	Whse.	SA	230	450/1350
40	Gen. Elec.	DLC	230	750
40	Roth	S	115	850
40	Whse. (2)	SK158	230	575
35	Cr. Wh. encl. int.	35 K-CCM	230	1150
30	Sprague	LC	230	600/1200
30	Sprague	dynamom	250	800/2000
25	Gen. Elec.	DLC	115	750
25	Roth	elevator	230	725
25	Whse. enclosed	SK	230	600
20	Gen. Elec.	DLC	230	500/1500
20	Fair Morse	TR	230	325/700

QUICK SHIPMENT FROM STOCK

SQUIRREL CAGE MOTORS

3 Phase—60 Cycles—220 or 440 Volts

Qua.	H.P.	Mfr.	Type	Speed
1	150	Whse. New b. b.	CS771.18	1800
1	150	Whse.	CS	900
1	100	Gen. Elec.	I-K	720
1	75	Gen. Elec.	I-K	600
1	50	Gen. Elec.	KT546	600
1	50	Gen. Elec.	I-K	720
1	40	Gen. Elec.	I-K	600
2	40	Allis Ch.	AN	1200
1	40	Howell 440 v.	SCBB	3600
1	40	Allis Ch.	AN	720
1	40	Gen. Elec.	I-K	1200
2	30	Allis Ch.	AN	1200
1	30	Allis Ch.	AN	600
6	30	Allis Ch.	AN	900
2	30	Gen. Elec.	KT326	1200
1	30	Gen. Elec. b. b.	FT 503	3600
2	30	Gen. Elec.	KT336	720
3	25	Whse. New	CS365	1800
2	25	Allis Ch.	AN	1200
1	25	Gen. Elec.	KT322	1200
2	25	Allis Ch.	AN	900
1	25	Allis Ch.	AN	600
3	20	Whse. New	CS364	1800
2	20	Gen. Elec.	I-K	1200
3	20	Whse.	CS	900
1	20	Ideal	AA	1200
3	20	Gen. Elec.	KT312	1200

25 CYCLE MOTORS

H.P.	Mfr.	Type	Speed
450	Whse. 2200 v.	CW sl. rg.	750
300	Whse.	CW sl. rg.	500
150	Whse.	HD sl. rg.	500
150	Gen. Elec. 2200 v.	MT359 sl. rg.	1500
100	Whse.	CCL sq. cg.	500
100	Gen. Elec.	I-K	750
50	Allis Ch.	ANY sl. rg.	1500
25	Gen. Elec.	I-K	1500

SYNCHRONOUS MOTORS

H.P.	Mfr.	Type	Volts	Speed
350	Gen. Elec. 3 brg.	ATB	220/440	600
300	Whse.	ped.	220/440	900
290	Gen. Elec.	ATI	2200	600
250	Gen. Elec. 1-brg.	ATI	220/440	600
190	Gen. Elec.	ATB	220/440	600
100	Elec. Machy.	BRKT	220/440	1800
75	Ideal	SMS	220/440	1200
60	Gen. Elec.	TS	220/440	900
50	Burke		220/440	1200

CENTRIFUGAL PUMPS

14" Foster Wheeler, 5000 gpm @ 45 ft.
10" Weinman, 2500 gpm @ 40 ft.
8" Alberger, 200 gpm @ 80 ft.
6" Platt, 1000 gpm @ 230 ft.

SLIP RING MOTORS

3 Phase—60 Cycles—220 or 440 Volts

Qua.	H.P.	Mfr.	Type	Speed
1	400	G.E. 2200 v.	I-P	1200
1	350	Whse. 2200 v.	CW	720
1	300	Burke	EMV	225
1	300	Whse.	HF	400
1	300	Gen. Elec.	MT410	450
1	300	Gen. Elec.	I-P	720
1	250	Gen. Elec.	I-M	600
1	200	Gen. Elec. 2200 v.	I-M	600
1	175	Lincoln	IXV	600
2	150	Allis Ch. 3 brg.	ANY	514
1	100	G.E. 2200 v.	I-E13A	1800
1	100	Gen. Elec. 3 brg.	I-M	450
1	100	Gen. Elec.	I-M	600
1	75	Gen. Elec.	I-M	600
1	75	G.E. 2200 v.	I-E13	1800
1	75	Gen. Elec. 2200 v.	I-M	900
1	65	P. & H. b. b. Int.	CA16	900
1	60	Whse. 2200 v.	CW657	1800
2	60	Gen. Elec.	M-505	1200
1	50	Gen. Elec.	MT536	1200
1	50	Al. Ch. b. b. 2200 v.	ARY	900
1	50	Gen. Elec.	MT342	900
1	50	Gen. Elec.	I-M	600
1	40	Gen. Elec. 2 ph.	MQ536	900
1	40	North'n	HW35A	1200
2	40	Gen. Elec.	MT532	1200
1	40	Fair Morse b. b.	HV	900
1	40	Whse.	CW	900
2	40	Gen. Elec.	M546	514
2	40	Allis Ch.	ANY	450
1	35	Fair Morse, b. b.	HV	1800
1	30	Northwestern b. b.	HW404	1800
2	30	Allis Ch.	ANY	900
2	30	Whse. enclosed	MA	600

D. C. GENERATORS

KW	Mfr.	Type	Volts	Speed
50	Cr. Wheeler	CC	125	1800
40	Whse.	SK	250	720
35	Gen. Elec.	DLC	250	900
30	Lincoln b. b. 600 amp.		50	1200
25	Gen. Elec.	DLC	125	900
25	Gen. Elec.	LC	250	900
20	Whse.	SK	250	1200
19	Gen. Elec. 300 amp.	CD	65	1200
16	Cr. Wheeler	CCD	125	415

ALSO IN STOCK . . . OIL SWITCHES BLOWER & FANS . . . SPEED REDUCERS . . . 500 NEW MOTORS

60 CYCLE A. C. GENERATORS

KVA	Mfr.	Type	Volts	Speed
500	Gen. Elec. 3 brg.	ATB	2300	45
300	Gen. Elec. 3 brg.	ATB	240/480	60
300	Whse.	ped.	240/480	90
300	Elec. Machy. 3 brg.		240/480	72

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1436-38 W. RANDOLPH STREET — CHICAGO 7, ILL. — MONroe 7409

TURBO GENERATORS

1—937KVA Gen. Elec. with Wheeler condenser

1—500KW Allis Chalmers Moore non-cond.

1—500KW Gen. Elec. non-cond.

1—300KW Gen. Elec. cond.

ROTARY CONVERTERS

1—1500KW 250V Westgh complete

2—1000KW 250V Westgh complete

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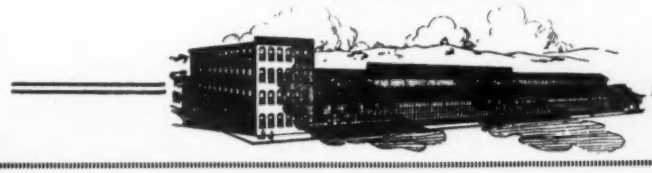

MOTORS • GENERATORS • TRANSFORMERS

MOTORS

3 phase, 25 cycle, 220/440 Volts

HP	Make	Type	RPM	Serial No.
15	G.E.	KT327	750	1781884
15	Allis Chal.		720	84242
15	G.E.	I-K	750	685100
15	West.	CCL	1500	816324
20	West.	CS	715	2691183
20	West.	CS	730	1949877
18	Otis	15	750	104787V
20	Allis Chal.		720	3K28825
20	Wagner	BP22T	750	119028
20	Reliance		720	Z20194
25	Allis Chal.	AR20A	750	220-A-623-4209-3
25	G.E.	I4	750	292596
25	Rob. & Myers	K	720	P515362
25	Triumph	TR12	750	C14248
30	Wagner	22VBM8	710	127097
30	Wagner	22VBM3	725	171477
30	West.	CCL	710	602618
30	G.E.	KT327	1440	2302731
40	West. (2200 v.)	CCL	710	854121
38	Otis	AC 750/187½		70052Y
38	Otis	AC 750/187½		70061Y
40	Wagner	22TLBP	1425	318604
40	West.	CCL	710	1032102
50	G.E.	I-K	1455	4015021
75	West.	CS	735	2207524
100	G.E.	KT553	1500	4820366
100	West.	CCL	480	808349
150	G.E.	I-K	363	2246835
150	G.E.	I-K	365	2246834
150	G.E. (2200 v.)	KT557Y b.b.	1460	5227355
150	G.E. (2200 v.)	KT557Y b.b.	1470	5269758
150	G.E. (2200 v.)	KT557Y b.b.	1460	5227354
225	Elec. Mach. (2200/440 syn.)		500	504129
1150	G.E.	ATI (syn.)	375	696425

MOTOR GENERATOR SET

1—125 KW Ridgeway 250 V. DC 1200 RPM, direct connected to 180 HP. Ridgeway Motor 3/60/440 Volts 1200 RPM DC. Panel and Starting Compensator.

FREQUENCY CHANGER SET

1—1250 KVA Gen. Elec. Synchronous—motor 3/25/2300 750 RPM direct connected to Generator 3427½/440 V. Complete with exciters and panels.

TRANSFORMERS

3—150 KVA General Electric Type 11, Form KS, 2400 Volts Primary 120/440 Volts Secondary.

REBUILT MOTORS

3 Phase 60 cycle 220/440 Volts

HP	Make	Type	RPM	Serial No.
15	Crocker Wheeler		600	131413
15	Westinghouse	CS	1200	1883285
15	Westinghouse	MS	1200	9445934
20	Westinghouse	CS	1200	2160590
20	Westinghouse	MS	1200	1056826
20	Westinghouse	MS	1200	1246745
20	Westinghouse	MS	1200	1056827
20	Westinghouse	CS	1800	1863526
20	Westinghouse	CS	1800	1930159
20	Westinghouse	CS	1800	2695044
25	Westinghouse	MS	1800	1562026
25	Westinghouse	MS	1800	1234763
25	Westinghouse	CS	1200	2286768
25	Westinghouse	MS	1200	1197673
25	Wagner	BP	1200	126906
30	Armor	BB	720	4343
30	Crocker Wheeler		720	17270
30	Westinghouse	MS	1200	1197674
30	Fairbanks-Morse	V-H-10D	1800	43476
40	Westinghouse	CS	900	1896969
40	General Electric	I-K	1800	73318
40	General Electric	I-K	1800	68511
40	General Electric	I-K	1800	77017
40	General Electric	I-K	1800	73316
40	Westinghouse	MS	1800	1506800
40	Westinghouse	MS	1800	1051548
40	Westinghouse	MS	1800	1056802
40	General Electric	I-K	1200	181444
40	Westinghouse	MS	1200	1027421
50	Westinghouse	MS	1800	1289389
50	Westinghouse	MS	1200	854416
50	Westinghouse	CS	1800	2691183
50	Westinghouse	CS	1800	1949877
50	General Electric	14	1800	181444
50	Reliance		1800	Z20194
50	Allis Chalmers		1800	3K28825
60	Westinghouse	CS	900	4884402
60	Reliance		1200	B11458
60	General Electric	I	1800	292596
60	Westinghouse	CCL	1800	329654
60	Robbins-Myers	K	1800	P515362
60	Triumph		1800	C14248
60	Westinghouse	CCL	1200	854121 (2200 v.)
75	Westinghouse	CS	1800	2134671
100	Westinghouse	CS	900	2207524
100	Westinghouse	CCL	1800	1043213
100	Westinghouse	CCL	1800	765231 (2200 v.)
125	General Electric	KT562	720	Ball bearing
125	Westinghouse	CS	1200	2318625
150	General Electric	KT568	450	
150	Westinghouse	CS	1800	2429726
150	Westinghouse	CCL	900	438385
150	Westinghouse	CS	1200	4572596 (2200 v.)
150	General Electric	I-K	720	122809 (2200 v.)
150	Westinghouse	CCL	720	808349 (2200 v.)
200	General Electric	KT563	514	
200	General Electric	I-K	900	232917 (2200 v.)
200	Westinghouse	CCL	900	919537 (2200 v.)
250	General Electric	KT568	600	
250	General Electric	I-K	600	2246834
300	General Electric	KT568	720	
300	General Electric	I-K	720	2357743
400	General Electric	I-K	900	2347845
400	General Electric	KT568	900	

SLIP RING MOTORS

3 Phase 60 cycle 220/440 Volts

HP	Make	Type	RPM	Serial No.
20	Westinghouse	CW644C	575	8009992
20	General Electric	MT332	545	3889010
30	Westinghouse	HF	1745	1558408
40	Westinghouse	CW748	690	4406823
40	Westinghouse	CW748	690	4406825
40	Westinghouse	CW748	690	4406821
40	Westinghouse	CW748	690	4406819
40	Westinghouse	CW748	690	4405824
40	Gen. Elec. (new)	M.445	1200	Ball Bearing
250	Allis Chalmers	3 bearing	505	104390 (2300 v.)
400	General Electric	I-M	900	224674
400	General Electric	I-M	900	246762

MAGNETIC CONTACTOR

400 HP. Gen. Elect. Type CR. 7006. Form D12D. 3/60/440 Volts.

CURRENT LIMITING REACTOR

60 KVA. Westinghouse 1 Phase 25 Cycle 6.2% on 12000 Volt Lines.

ERIE ELECTRIC CO., INC.

124 CHURCH ST. BUFFALO, N. Y. CL. 4758

CHICAGO'S LARGEST STOCK GUARANTEED EQUIPMENT

MOTOR-GENERATOR SETS

KW	Make	DC Volts	AC Volts
1000	Wtg.	275 Ind.	3/60/4100
750	Elliott	275 Syn.	3/60/440
300	G.E.	275 Syn.	3/60/2200
225	Ideal	115 Syn.	3/60/2200
200	G.E.	250 Syn.	3/60/2300
150	G.E.	250 Syn.	3/60/2300
100	Cr. Wh.	230 Syn.	3/60/440
100	G.E.	3 wire Syn.	3/60/480
100	G.E.	250 Syn.	3/60/440
75	G.E.	125 Ind.	3/25/220
75	G.E.	125 Ind.	3/25/440
90	Wtg.	110 75 KVA	3/60/2300
60	Al. Ch.	110 Ind.	3/60/2300
35	G.E.	250 Ind.	3/60/220
35	Century	240 Syn.	3/60/240

SLIPRING MOTORS

3 phase, 60 cycle

HP	Make	Type	Volts	Speed
2850	Wtg.	CW	6600	450
800	Wtg.	CW	6600	507
500	Al. Ch.		440	600
600	G.E.	MT	2200	514
600	Al. Ch.	ANY	2200	1180
600	Wtg.	CW	2300	343
350	Wtg.	CW	220	700
350	G.E. 3b.	IM	2200	600
300	G.E.	IM	2200	514
300	G.E.	MT	440	450
300	Wtg.	HF	430	386
200	F. Morse		440	600
400	Wtg.	CW	440	450
300	Al. Ch.		440	705
250	G.E.	IM	440	720
250	G.E.	IM	2200	600
150	G.E.	IM	440	875
150	Al. Ch.	ARY	440	880
150	Wtg.	CW	440	600
150	G.E.	IM	440	450
100	G.E.	IM	2200	1800
100	Wtg.vert.	CW	2200	1160
100	Ideal	AV	2300/440	720
100	Westg.	HF	440	230
75	G.E.	MT	220	1800
75	G.E.	MT	440	860
60	Al. Ch.	ARY	220	690
50	G.E.	MT	440	1800
50	G.E.	IM	220	900
50	Al. Ch.	ARY	220	690
50	G.E.	MT	2200	600
50	Wtg.	CW	440	570

This is a partial listing only.

SQUIRREL CAGE MOTORS

3 phase, 60 cycle

HP	Make	Type	Volts	Speed
1000	G.E.	K	2200	509
700	G.E.	HF	2200	1800
500	Wtg.	CS	2200	1750
350	G.E.	KT	440	1765
250	G.E.	IK	440	1750
200(3)	G.E.	KTP	2200	1170
200	Wtg.	CCL	440	1200
200	G.E.	IK	440	580
200	Wtg.	CS	440	600
150	G.E.	IK	4200	1200
150(6)	Al. Ch.	AR	440	900
150	Wtg.	CS	2200	720
150	Al. Ch.		440	570
150	G.E.	IK	440	575
100	Wtg.	CS	2200	1750
100	Wtg.	CS	440	900
100	Wtg.	CS	2200	870
75	G.E. tot enc	KF	440	3575
75	G.E.	KT	2200	1800
75(9)	Al. Ch.	AR	2200	1765
75	Westg.	CS	2200	870
75	G.E.	KT	440	870
75	Wtg.	CS	220	600
75	Al. Ch.		440	385
60	G.E.	KT	440	865
60	Wtg.	CS	220	435
60	Wtg.vert.	CS	2200	1750
50	G.E.	KT	440	600
50	G.E.	KT	440	900
50	G.E.	IK	440	1200
40	G.E.	KF	2200	1745
40	G.E.	KT	220	1745
40	Wtg.	C	440	850
40	Al. Ch.		440	850
40	F. Morse	H	2200/440	720
40	Al. Ch.		440	570
35	G.E.	IK	440	1200
35	Wtg.	CS	2200	1175
35	G.E.	KT	220	900
35	G.E.		2200	900
35	Al. Ch.		440	680
35	Al. Ch.		440	480
30	G.E.	KT	220	860
30	G.E.	KT	440	900
30(2)	Wtg.	CCL	220	840
30(2)	Al. Ch.		440	860
30	G.E.	KT	220	600
25	Ideal	AA80	220	1740
25	Cr. Wh.	118Q	440	1150

This is a partial listing only.

FREQUENCY CHANGER

1—1400 HP General Electric type ATI-24-1250M-300, form C, 3 ph. 60 cy. 460 volt, 300 RPM, 1570 amps, 1250 KVA, 0.9 P.F. 50° synchronous motor with amort. wdg.; dir/conn. to 1000 KW General Electric type AT1-10-1250M-300, 3 ph. 25 cy. 460 volts, 300 RPM, 1570 amps. 1250 KVA, 0.8 P.F. 50° A.C. generator with amort. wdg., with 33 KW G.E. 125 volt direct connected exciter. (This is a three brg. unit suitable for operation from either end.)

SYNCHRONOUS MOTORS

3 phase, 60 cycle

HP	Make	Type	Volts	Speed
5000	Wtg.	conds.	2300	900
2100	G.E.	ATI	4600	514
3000	Al. Ch.	conds.	2300	900
1000	Wtg.		440	900
750	Al. Ch.		440	1200
750	G.E.	conds.	550	900
500	G.E.	TS	2200	720
500	G.E.	TS	2200	600
500	G.E.	TS	2300	450
300	G.E.	conds.	480	900
270	G.E.	ATI	440	600
150	Burke	S1375	2200	600
100	Cr. Wh.		240	900
75	G.E.	ATB	220	1200
50	ELM.	.8	240	1200
10	G.E.	ATI	240	900
5	G.E.	K324	220	1800

reluctance type

VARIABLE SPEED D.C. Motors

HP	Make	Type	Speed
100	G.E.	C	1100/1200
25	Wtg.	S8	550/780
25	G.E.	DLC	500/1000
20	Wtg.	SK113	500/1000 (4)
15	G.E.	RC16	500/700
15	G.E.	CE	650/950
14	G.E.	C	700/1400
12	Wtg.	SKS0L	500/1000 (2)
10	El. Dyn.		600/1200
12½	G.E.	C	700/1400
4	G.E.	C	800/1400
5	Burke	AM12	500/1500
5	Burke	WAM12	650/1950

A. C. GENERATORS

KW	Make	Volts		Speed
2500	Wtg.	6600		450
1250	Ideal	2200		1200
300	G.E.	480		900
200	Westg.	2400		900
75	Burke	AC16	240	1200
72	F. Morse	AB	440	900
75	G.E.	ATB	230	1200
60	F. Morse	D	2300	300
8	G.E.	ATI	240	900

TRANSFORMERS

KVA	Make	Prl. V.	Sec. V
5—1000	G.E.	13200	2300
2— 667	Moloney	13200	460
3— 500	G.E.	33000	480
1— 100	G.E. 3 ph.	9000	230
3— 75	Wtg.	3810	244/122
2— 50	G.E.	2200	440/220
1— 20	G.E.	2200	220/440
1— 15	G.E.	1050/2100	2200/288
1— 15	G.E.	2400	120/240
1— 7½	G.E. 3 ph.	2200/3810	220/440
1— 7½	G.E.	1100/2200	220/440
1— 6	Kuhlman	100	20
1— 5	Sorgel	140	220
1— 5	G.E.	1100/2200	110/440
1— 5	G.E.	1100/2200	220/440
5— 3	G.E.	440	110/55
1— 3	Moloney	1150	115/230

VERTICAL A.C. MOTORS

HP	Make	Type	Volts	Speed
100	Wtg.	CW	2200	1160
60	Wtg.	CS	2200	1800
35	F.M.	UAV	220	1800
10	G.E.	KT	220	3600
7½	F.M.	b.b.	220	850
5	Wtg.	CS	220	

BOILERS

502 HP B & W Stirling water tube ASME, 200 lbs. complete with pulverizer, blowers, fan, etc.

2—800 'Twin setting' B & W Stirling. ASME, 200 lbs. all complete, excellent condition.

2—510 HP Heine straight tube, 200 lbs. less firing equipment.

2—520 HP B & W sectional header straight tube water tube, 200#.

WE ARE ALWAYS IN THE MARKET FOR ALL TYPES OF GOOD MODERN ELECTRIC MOTORS, MOTOR-GENERATOR SETS GENERATORS, TRANSFORMERS, AND OTHER ELECTRICAL EQUIPMENT. SEND US YOUR LISTS FOR BEST CASH OFFERS.

CHICAGO ELECTRIC CO.

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CHICAGO 8, ILL.

REBUILT POWER EQUIPMENT

READY TO SHIP!

SLIPRING MOTORS—3 PH., 60 Cy.

H.P.	Make	Volts	R.P.M.	Type
20	Westg.	220	575	CW
20	Allis Chal.	440	1130	
25	Westg.	220	720	CW
30	Westg.	220	900	CI
30	West.	220/440	787	CI
40	Triumph	440	1760	
50	West.	220/440	860	CW
50	West.	220/440	720	CW
50	Westg.	440	1145	HF
50	Chandeys'n	220/440	1800	
60	West.	220/440	720	CW
75	West.	220/440	900	CW
75	West.	220/440	720	CW
100	West.	220/440	900	CW
100	West	220/440	685	CW
150	West.	220/440	690	CW
260	Burke	440	600	EMV-65
300	G.E.	440	900	I
400	Westg.	2200	435	CW-1214
1500	Westg.	2200	435	CW

ALTERNATING CURRENT MOTORS

3 ph. 60 cy.

H.P.	Make	Volts	R.P.M.	Type
25	West.	220/440/550	1200	CS
25	Lincoln	440	900	
25	West.	220/440	1160	CS
30	G.E.	440	1800	KT
30	Allis Chal.	220/440	1200	
30	West.	220	450	CS
35	West.	220	495	CS
35	West.	220/440	575	CS
40	Howell	220	900	SO
40	G.E.	440	1800	KT-527-4
40	Triumph	440	1760	S8825
40	G.E.	440	900	KT
40	West.	220/440	720	CS
45	West.	220/440	850	CS
50	Burke	220	720	EM-10
50	West.	220/440	900	CS
50	West.	220	600	CS
50	G.E.	220	1200	
50	Fair Morse	220	900	
50/150	West.	2200	360/720	CS-954
50	West. El.	220	570	KT-346
50	Chandeys.	220/440	1800	
50	Cr. Wh.	240/480	1200	Syn.
50	G.E.	220/440	1200	HI
50	G.E.	440	1160	KT
50/32	G.E.	440	800/640	
65	West.	220	720	CS
75	Burke	220	900	EM-10
100	Burke	220	1200	EM-10
100	West.	440	690	HF
100	Allis Chal.	220	600	
150	Wagner	440	1800	31V
150	G.E.	2200/220/440	450/243	
175	GlEl	2200	600	I-12
200	Westg.	2200	900	
1500	G.E.	2200/220/440	225	ATI-Syn.
3500/4000	West.	4000/23000	900	Syn.

VARIABLE SPEED MOTORS—230 VOLT D.C.

H.P.	Make	R.P.M.	Type
1.5	Roth	850/1700	
2	Star	400/600	SB
2	G.E.	400/1600	RLC
2	G.E.	415/830	RLC
2	Reliance	550/2000	
2½	Westg.	450/900	SK-30
2½	G.E.	500/1000	RLC
2½	Reliance	500/1000	14T
3	Jantz-Liest	650/1950	BI-DC
3	Roth (enclosed)	500/1000	RS
3	G.E.	400/1200	RLC-114
3	West.	500/2000	SK
3½	Westg.	400/1600	SA
3½	Westg.	850/1700	
4	G.E.	850/1700	LC-8
5	G.E.	500/1000	
5	Reliance	600/1800	
7½	Westg.	450/900	80L
7½	Westg.	400/1600	SA
10	Westg.	565/1130	8-6
10	G.E.	625/1250	LC
10	West.	400/1600	SA
15	Reliance	500/1800	
20	Westg.	750/1500	SK-110L
30	G.E.	450/900	RLC
75	West.	400/650	SK-181

SERIES WOUND MOTORS

H.P.	Make	Volts	R.P.M.	Type
6	Ilg.	230	380	
10	West.	230	650	MT-00
15	Cr. Wh.	220	270	SM
15	West.	230	800	HD
25	West.	230	600	MT
32	Shaw	230	485	5L2E
68	G.E.	220	475	
80	West.	230	490	76-A
175	G.E.	230	475	MD

TRANSFORMERS

1 ph. 60 Cy.

No.	Kva.	Pri.	Sec.	Make
1	2	1040/2080	52/104	G.E.
1	2	6600	110/220	G.E.
1	2½	1040/2080	52/104	G.E.
2	3	2200/2100/2000	440/220/110	West.
1	3	2200	110/220	G.E.
1	5	2000/4000	80	West.
3	5	2200	220/440	G.E.
4	5	2200/1100	110/220	G.E.
1	5	2200	110/220	West.
4	5	2200	110/220	G.E.
1	7½	2200	110/220	West.
69	7½	1100/2200	110/220	G.E.
29	7½	2200/1100	110/220	West.
8	7½	2200/1100	440/220/110	West.
6	10	2200/1100	220/110	West.
10	10	2200/1100	220/110	G.E.
2	10	2300	220/110	G.E.
1	10	2200/1100	440/220/110	West.
21	15	2200/1100	440/220/110	West.
3	15	2200	220/440	G.E.
2	15	2300	230/460	American
3	15	2200	110/220	Packard
3	15	2200	110/220	Cr. Wh.
16	18	220	19½/38½	El. Furnace
2	20	1150/2300	115/230	Maloney
2	20	2300	230/460	American
1	20	2300	110/230	West.
2	20	2200/1100	440/220/110	West.
2	25	2300	230/460	American
2	25	2300	110/220	West.
3	40	2200/1100	220/110	West.
1	40	1100/2200	110/220	Pittsburgh
1	40	2300/1150	115/230	Maloney
2	50	2200	110/220	Packard
1	50	6600	550/440	Allis Chal.
1	50	2200/1100	220/110	West.
2	50	2200/1100	220/110	Maloney
3	75	2300	206–103 Rotary	G.E.
1	100	2300	230/115	Standard
3	125	2200	220/440	G.E.
2	150	2200/2300/2400	220/230/240	G.E.
3	250	6600/5940	2300	West.

HOIST

1—3 ton Westghse Hoist with Westghse DC Mtr., 1600 rpm.

D.C. CLARK CONTROLLER

1—250 HP Clark Vari time magnetic controller 230 v. DC reversing, used for plugging service. Can also be used non-reversing.

MOTOR GENERATOR SETS

250 V. D.C.

1—5kw. Allis Chalmers 1150 rpm. Gen. dir. conn. to 220/440 v. 3 ph. 60 cy. Induction Motor.

1—7½ kw. West. 1150 rpm. Gen. dir. conn. to 220/440 220/440 v. 3 ph. 60 cy. Induction Motor.

1—10 kw. West SK 1150 rpm. Gen. dir. conn. to 220/ v. 3 ph. 60 cy. Induction Motor.

1—15 kw. West. 1150 rpm. Gen. dir. conn. to 220/ 440 v. 3 ph. 60 cy. Induction Motor.

1—20 kw. West. 1150 rpm. Gen. dir. conn. to 220/ 440 v. 3 ph. 60 cy. Induction Motor.

1—25 kw. Triumph 1750 rpm. Gen. dir. conn. to 220/ 440 v. 3 ph. 60 cy. Induction Motor.

1—25 kw. West. 1150 rpm. Gen. dir. conn. to 220/ 440 v. 3 ph. 60 cy. Induction Motor.

1—70 kw. West. 250 v. 575 rpm. DC Gen. dir. conn. to 440 v. 3 ph. 60 cy. AC Motor.

1—150 kw. West. 250 v 900 rpm Gen dir conn to 290 HP 440 v. 3 ph. 60 cy. West. Syn. Motor.

3—250 kw. Cr. Wh. 250 v. 500 rpm. DC Gens. with 3—250 kva. Cr. Wh. Syn. 220 v. 3 ph. 25 cy. Motors.

125 volts

1—5 kw. 125 v. 1150 rpm. Allis Chal. Gen. dir. conn. to 3 ph. 60 cy. 220/440 v. AC Induction Motor.

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Duquesne Electric & Mfg. Co. Pittsburgh 6, Pa.

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43,945 HORSEPOWER

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MODERN—IMMEDIATE DELIVERY

Complete Plants

10,800 H.P. Busch-Sulzer—9,000 KVA-4 units 1-3-4-6 Engine Generator Plants

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1500 H.P.—1500 KVA Capacity and Smaller Sets

Fairbanks-Morse, Superior, Atlas Imperial, Buckeye, Chicago Pneumatic, Washington Iron Works, Busch-Sulzer, McIntosh-Seymour, General Motor, De La Vergne, Ingersoll Rand, Worthington

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Business Established 1898

JUST PURCHASED

2-300 K. W.

BURKE 250/125 volts

Direct Current

SYNCHRONOUS MOTOR GENERATOR SETS

SPECIFICATIONS

2—300 K.W. Burke 4 bearing Synchronous Motor Generator Sets, 3 wire, 250/125 volts Direct Current, Type CB67, 900 R.P.M. 1200 Amperes, Compound Interpole, Serial Nos. 136014 and 136129 on common sub-base direct connected to 450 H.P. 4160 volt, 3-phase, 60 cycle, .85% P.F. Synchronous Motor, type AC88, Serial Nos. 136010 and 136011.

Complete with A.C. Reduced Voltage Starting Panel with auto transformer and D.C. Panel Board

Modern Equipment — Like New — Can be seen in Operation

LOCATION: CLEVELAND, OHIO

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Established 1910

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Phone: CAnal 6-6976

1—440 HP Elec. Machinery, 3-60-440V, 900 RPM, two bearing syn. motor
1—400 HP Westinghouse, type CW, 3 ph. 60 cy. 440V, 450 RPM slip ring motor
1—300 HP General Electric, 3 phase, 60 cycle, 440 volt, 360 RPM, type Mt 412 slip ring motor
1—275 HP Allis-Chalmers, 3 phase, 60 cycle, 440 volt, 1175 RPM slip ring motor
1—250 HP General Electric, 3-60-440V, 450 RPM, type 1-M slip ring
1—200 HP Westinghouse, 3-60-2200V, 600 RPM syn. #4956114, direct conn. exciter and starter
2—100 HP General Electric, type I, form K, 3-60-220V 575 RPM
1—100 HP Westinghouse, type CCL, 3 ph. 60 cy. 2200 V, 1750 RPM, Squirrel Cage
1—100 HP Allis-Chalmers, type ANY, 3 ph. 60 cy. 220V, 580 RPM slip ring.
1—100 HP General Electric 3 ph. 60 cy. 4000V, 720 RPM syn., type TS with direct connected exciter
1—150 HP Allis-Chalmers 3-60-440 V. 450 RPM slip ring
3—100 HP, General Electric, 3-60-440V, 450 RPM sq. cage
4—75 HP G. E. 3-60-2300V, 400 RPM, type I, sq. cage
1—75 HP General Electric, 3 phase, 60 cycle, 440 volt, 450 RPM, type I, form M, slip ring motor
1—75 HP Allis-Chalmers, 3 ph, 60 cy. 440V, 450 RPM slip ring
1—75 HP Fairbanks-Morse, type H, frame 105C, 3 ph, 60 cy, 550V, 900 RPM Squirrel Cage
1—75 HP Lincoln, type 1Q, 3 ph. 60 cy. 3 phase, 440V, 600 RPM Squirrel Cage
2—75 HP Fairbanks-Morse, 3 phase, 60 cycle, 2200 volt, 1800 RPM, slip ring motors
1—60 HP Lincoln 3-60-220V frame IXM, Sq. Cage, 900 RPM
1—50 KW factory built m-g set, 125 Volt Ideal 900 RPM driven by 75 HP, sq. cage 220/440 V. motor
1—60 HP General Electric, 3-60-440V, 720 RPM, type I, form K
1—60 HP General Electric, 3-60-440V, 1750 RPM, type I slip ring
1—60 HP General Electric, 3 phase, 60 cycle, 440 volt, 600 RPM, type MT 556 slip ring motor
1—50 HP General Electric 3-60-220V, 1150 RPM, type I, slip ring
1—50 HP Triumph 3-60-440V, type C12 1150 RPM, slip ring, rotor & stator rewound
1—50 HP General Electric, 3-60-440V, 900 RPM, type 1-M, slip ring
1—50 HP General Electric, 3-60-440V, 720 RPM, type IK, Sq. Cage
2—50 HP Allis-Chalmers, 3-60-440V, 890 RPM, slip ring
1—50 HP General Electric, 3-60-440V, 690 RPM, MT 548, slip ring
1—50 HP Wagner 3-60-440V, 495 RPM, type BM, Sq. Cage
1—50 HP Allis-Chalmers, 3-60-440V, 490 RPM, Sq. Cage
1—50 HP Westinghouse CS 2-60-440V, 420 RPM, Sq. Cage
1—50 HP General Electric type I-M, 3 ph. 60 cy. 440V, 720 RPM slip ring
1—45 KVA Fairbanks-Morse, 3 ph. 60 cy. 220 V, 1200 RPM alternator
2—30 HP Fairbanks-Morse, 3 ph. 60 cy. 2220V, 3600 RPM, type HO, frame 12B ball bearing
1—50 KW, Allis-Chalmers, factory-built, 3 bearing M-G set, 125 volt DC driven by 75 HP, 3 phase, 60 cycle, 220 volt 1165 RPM motor
2—175 HP, 230V, DC Westinghouse, type SK, 150 to 550 RPM
1—100 HP General Electric, type CD, fr. 123, 230V, 1200 RPM
1—80 HP Westinghouse, type SK140L, 115V 1150 RPM vertical
1—50 HP Westinghouse SK200, 230V, 250/900 RPM

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Hamilton, Ohio
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1000 KW. 250 v. steam engine generator set

500 KW. DC M.G. 600 v. DC 900 speed, Allis Chalmers. For any AC voltage drive

400 KW. 3 unit 250/500 volt Gen. Elec. Syn. M. G. set, 2300/4000 volt AC drive

120 KW. 250/500 v. DC gasoline engine gen. set

100 KW. 125 volt, G.E., 1200 rpm. M.G. set any AC volt

70 KW. M.G. Set 70 v. 1000 Amp. Burke, syn. drive

35 KW. 125 v. M. G. set. For any AC voltage drive

50—New 3 HP. G.E. 1800 rpm. 220 volt slip ring motors

100 KW. 125/250 volt, 1200 rpm. General Electric synchronous rotary converter

300 KW. 250 v. West. 900 rpm. syn. rotary converter

4—200 HP. G.E. type KF vertical 440-60-3-900 Class 1-D explosion proof motors

1—100 HP. same description as above

129—15 KW. Westinghouse type SK 83, 125 volt, 1200 rpm. New D. C. Generators

3—200 HP. G. E. type KT 440-60-3-900 bare motors

2—100 HP. G. E. type KT 440-60-3-600 BB motors

15—New Reliance type 2VS vertical MG sets

18—New Reliance type 5 VS vertical MG sets

ELECTRIC EQUIPMENT CO.
BOX 51, ROCHESTER, N. Y.
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SYNCH. CONVERTERS

500 KW AL-CH. 250 D.C. 2300/4000 A.C. 1200 RPM
300 KW G.E. 600 D.C. 2300/4000 A.C. 1200 RPM
150 KW WEST 250 D.C. 2300/4000 A.C. 1200 RPM

MOTOR GENERATORS

300 KW WEST. SYN. 250 V. 2200/4000 A.C. 900 RPM
200 KW G.E. IND. 600 V. 2300/4000 A.C. 1200 RPM

Each unit listed above is owned by us and is available now for immediate purchase

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502 Grant Building, Pittsburgh, Pa.

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1550 H.P. Elec. Boat Engine
480 KW Cooper Bessemer 2300 V.
300 KVA Fairbanks Morse 2400 V.
250 KW Ingersoll Rand 2200 V.
250 KW Busch Sulzer 240 V.
192 KW McIntosh Seymour 2300 V.
125 KW Cummings 220 V.
100 KW Busch Sulzer 2300 V.
75 KW Superior 2300 V.
75 KW Wolverine 220 V.
50 KVA Fairbanks Morse 2300 V.
12—11,500 & 20,000 Gal. Steel Tanks.
175 gal. hr. T. Jones oil heater.

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PUMPS—Large stock centrifugal—turbine—piston

STEAM PUMPS—Duplex - Simplex Reconditioned and guaranteed

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A. C. TURBINES

2—300 KW GENERAL ELECTRIC ALTERNATORS type ATB, form T, .80 P. F., 375 KVA 3/60/2300 volt, 3600 RPM, 94 Amps. Direct connected to:—
CURTIS TURBINES non-condensing, 175 lbs. type L-25"—2 stage, form C, serial #19177—#19178

FOR IMMEDIATE DELIVERY
IN A-1 CONDITION

ALJON ELECTRIC DIESEL CO.
151-55 Washington St., Brooklyn 1, N. Y.
Main 4-3804

SLIP RING MOTORS

3-HP., 60 CY.

HP	Volts	Make	Speed
400	440	G.E.	360
300	2200/440	G.E.	600
200	440	G.E.	450
300	440	Al. Chal.	900
300	2200	G.E.	1800
250	2300	G.E.	600
250	440/550	G.E.	600
250	440	Whse.	450
250	550	Al. Chal.	900
200	2200/440	G.E.	1200
200	2200/440	G.E.	600
150	440	G.E.	1800
150	4000/2300	G.E.	1800
150	2200/440	G.E.	600
125	440/220	G.E.	1200
125	440/220	G.E. (Holst)	900
125	2200	G.E. (New)	1800
100	440/220	G.E.	1800
100	220/440	G.E.	720
100	220/440	G.E.	900
100	440/220	G.E. MTC	900
100	550	G.E.	900
75	440/220	Whse.	720
75	550	G.E.	900
60	2200	G.E.	900
40	2200	Whse.	900
40	2200	G.E.	1200

SYNCHRONOUS MOTORS

3-HP., 60 CY.

300	440/220	Al. Ch.	600
200	2200	Whse.	900
110	440	Whse.	900
100	2200/550	Al. Ch.	1800
100	440/220	G.E.	360
75	440/220	G.E.	720

OUTDOOR OIL CIRCUIT BREAKERS

1—New 400 Amp. Type FK. 136-1328A, General Elec. 3PST, 25,000 Volt Oil Switch, Interrupting Capacity 125,000 KVA, complete CT's PT's, etc.

1—1200 ampere, type D 12, Condit, 7500 volt, 3 pst, hand-operated.

1—3000 ampere, type FK 25, General Electric, 3 pst, 600 volt.

TRANSFORMERS

60 CYCLE

3—500 kva., G.E., type H, form KS, 13800-230/460.
3—250 kva., Whse., 13,800-460.
3—250 kva., G.E., H KDD, 13200-2300/575 V.
3—200 kva., G.E., type H, 34500-2300 V.
3—150 kva., G.E., H-KDD 13200-2300.
3—150 kva., Al. Ch., type OISC 10400-2400.
3—150 kva., G.E., H-KS, 2400-240/120 V.
2—150 kva., G.E., HTQ, 4150-240/480 V.
3—100 kva., Whse., SK, 4200-460/230 V.
3—100 kva., G.E., type H 2400-240-480.
3—100 kva., G.E., type H-KDD, 6900/11950Y-230/115.
3—100 kva., G.E., type H-KR 6600/11430Y-2300 V.
2— 75 kva., G.E., type HK, 2300-230/115.
3— 50 kva., Moloney, 2300-230-115.
6— 50 kva., Whse., type SK, 13800-240/120.
3— 50 kva., Whse., 22,000-2300.

SQUIRREL CAGE MOTORS

HP	Volts	Make	Type	Speed
500	440/220	G.E.	IK	1200
500	440/220	G.E.	IK	900
400	2200/440	Whse.	CS	720
250	440/220	G.E.	IK	1800
200	220/440	G.E.	IK	720
200	440/220	G.E.	IK	900
200	440/220	G.E.	IK	1200
150	440/220	G.E.	KT	720
150	440/220	Whse.	CS	514
125	440/220	G.E.	KT	1800
125	440/220	G.E.	K	514
125	440/220	G.E.	KT (Vert).	1800
100	2200	G.E.	IK	600
100	2200	G.E.	IE-K	1800
100	550	G.E.	KT	900
74	2200	G.E.	KT	900
75	2300	G.E.	IE-K	1800
50	220/400	G.E.	K	1800

MOTOR GENERATOR SETS

1—75 KW, 250 V, 850 RPM, conn. to 110 HP, 440/220 V, Sq. Cage Motor.
1—50 KW, 250 V, 850 RPM, Whse. conn. to 75 HP, 440/220 V, 3 ph. 60 cy. Sq. Cage Motor.
1—50 KW., 125 V., 1200 RPM. Whse conn. to 75 H.P. 2200/220 V.; 3 ph., 60 cy., Sq. Cage Motor.
1—25 kw, 250 V, 1800 rpm, GE, conn. to 25 hp, 440 volt, 3 ph., 60 cy., Sq. Cage

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1—375 kva, 514 rpm, 480/240 V, GE
1—250 kva, 600 rpm, 440/220 V, Al. Ch.
1—110 kva., 900 r.p.m., 440 V., G.E.
1— 96 kva., 360 r.p.m., 480/240 V., G.E.
1—62½ kva., 1200 r.p.m., 2200 V., Cr Wh.

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1—Burke 300 HP 900 RPM 440/220 Volt
1—Ideal 50 HP 600 RPM 2300 Volt

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A large nummber of adjustable speed D.C. motors from 5 to 100 HP.

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3750 KVA Wghse. 600 v. (bleeder)
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3125 G.E. 480 v. (bleeder)
2500 Wghse. 600 v.
1560 (2) Al. Chal. 600 v.
1560 Wghse 480 v. (bleeder)
937 G.E. 2300 v.
625 KVA. G.E. 2300 v.
500 (3) G.E. 240 v.
375 G.E. 2300 v.
312 Elliott-Kerr, 480 v.
312 Moore (bleeder & Non-con.)

NON-CONDENSING

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110 KVA Al. Chal. 240 v.
50 Terry, 240 v.

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880 HP B & W 200#
612 Sterling 200#
328 HP. (4) Sterling 160 lb.
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180 B & W 3 drum, 160#

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300 KVA FM style VA
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120 HP. Chicago Pneumatic, belted

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COMPRESSORS
MOTOR GENERATOR SETS

PUMPS MOTOR & STEAM DRIVEN

G.P.M.	Head	Make	Type
9700	110′	Ing. Rand	Centrif.
6000	33′	LeCourtenay	Centrif.
3500	140′	Kingsford	Centrif.
2400	55′	American	Centrif.
1100	220′	Allis-Chalm.	Centrif.
1500	160′	De Laval	Centrif.
400	625′	LeCourtenay	Centrif.
250	525′	LeCourtenay	Centrif.
400	350′	Goulds	Triplex
300	500′	Goulds	Triplex
175	500′	Goulds	Triplex
500	175′	Blackmer	Rotary
450	231′	Kinney	Rotary
300	150′	Viking	Rotary
1000	460′	Knowles	Steam
750	460′	Snow	Steam
500	100′	Foster	Steam
2000	50′	Lawrence	Sump
300	231′	Gardner	Plunger

M. G. & STEAM DR. SETS

K.W.	Make	Volts	Type
25	Green Eng.	220 D. C.	Belt Drive
100	Ames	240 D. C.	dir. dr. Eng.
75	Ames	240 D. C.	dir. dr. Eng.
17	Sturt. Turbine	110 D. C.	Direct Drive
7½	Sturt. Turbine	110 D. C.	Direct Drive

D.C. MOTORS ALL SIZES

100 Northwest	220	1750
25 Roth	230	1750
10 Crock. Wheel	110	925
10 Weschge	110	1700

1½ to 7½ H. P. ALL MAKES

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Nash-Jenn Dump. Vac. Heat, 26000EDR
Nash-Jenn Simp. Vac. Heat, 1600EDR
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AIR COMPRESSORS

G.F.M.	Pressure	Make	Type
850	100	Laidlaw	Hor. Dup.
500	60	Ing. Rand	Steam
400	125	American	Horiz.
350	40	Worthing	Horiz.
140	125	Curtis	Vert. Dup.
100	125	Ing. Rand	Vert. Dup.
28	5000	Norwalk	4-Stage

TURBO-CENTRIFUGAL BLOWERS

1800	5¼ lbs.	In. Rand	Motor dr.
1350	24 oz.	Spencer	Motor dr.
900	10½ lbs.	In. Rand	Motor dr.
900	5¼ lbs.	In. Rand	Motor dr.
700	2½ lbs.	Allen Billmyer	Motor dr.
675	24-45 oz.	Spencer	Motor dr.
450	24 oz.	Spencer	Motor dr.
250	16 oz.	Spencer	Motor dr.

BLOWERS & EXHAUSTERS

C.F.M.	St. Pres.	Make	Type
100-60000	¼″-5″	Buffalo	Various
100-15000	¼″-16 oz.	American	Various

ROTARY PRESSURE BLOWERS

C.F.M.	Press	Make	Type
6000	3 lbs.	Roots	Belt dr.
3000	3 lbs.	Roots	Belt dr.
2000	3 lbs.	Sturt.	Belt dr.
1000	3 lbs.	Roots	Belt dr.
500	3 lbs.	Roots	Belt dr.
235	1 lb.	Fuller	Direct dr.
110	15 lbs.	Beach R	Belt dr.

VACUUM PUMPS

1000	15 in.	Roots	Belt dr.
350	27 in.	Worth	Belt dr.
100	high vac	Beach R	Gear dr.
100	27 in.	Deane	Belt dr.
100	29 in.	Devine	Belt dr.
100	20 in.	Nash	Direct dr.

MOTORS (3 ph. 60 cy.)

HP	Make	Volts	Speed	Type
150	West.	440	700	CS
125	G.E.	220	1150	Vertical
100	Lincoln	220	1750	
50	G.E.	2300	1750	I
50	West.	220	850	CCL
50	West.	220	570	CS
40	G.E.	220	870	342
30	Wagner	220	850	Sl. rg.

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1—1200 A. GE FK 132 A 3 PST 7500. Handle with Trip Coils and Current Transformer.
1—2000 A GE CK 8 Air Breaker 3 PST 600 V. O.I. & U.V.
1—3000 A GE FK 25 Oil Breaker 3 PST 600 V. Solenoid operated with currents.

Sq. Cage—220/440 V. 60 Cy. 3 ph.

Qu.	HP	Make	Type	Speed
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2	100	G.E.	IK	1800
1	150	West	CS	1800

Slip Ring—220/440 V. 60 cy. 3 ph.

1	40	West.	CW	720
1	50	G.E.	I-M	900
1	60	G.E.	I-M	900
1	75	West.	CW	900
1	250	West.	CW	1200

D. C. Variable Speed 230 V.

1	15	West.	SK	400/1600
1	25	West.	SK	400/1200
1	50	West.	SK	500/1500
1	50	G.E.	CD	400/1600

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1 — Westinghouse, 1000 KW, 3 ph, 2300 volt, 3600 RPM, condensing
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1000—KW. West. D.C.
1250—KVA. West. Sur. Cond. 200#, 2300.
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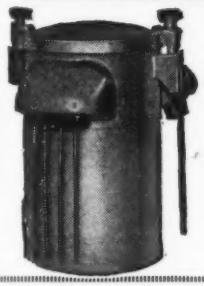

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1—500 HP Stirling, 200# pressure, new tubes, rebuilt.

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3—200 KVA Fairbanks-Morse Full Diesel Engines.
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400 KW General Electric 250 volt/125 volt d-c 450 RPM generator.
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1—300 KW Westinghouse 3/60/220-440 or 2300 volt-3600 RPM, non-condensing turbo generator.
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Transformers—1 KVA to 200 KVA.
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SLOW SPEED

MOTORS

SQUIRREL CAGE

H.P.	Make	Type	Volts	RPM
5	L.-Allis	Sq. C.	220	4 Speed
15	G. E.	HI	440	900
20	Westgh.	C	440	840
25	Cent.	AS-35	220	865
25	G. E.	HI	440	900
35	G. E.	I-12	2200	600
35	G. E.	HI	440	900
50	West. El.	I	440	600
50	G. E.	KT346	2300	685
50	Westgh.	CS	440	870
50	G. E.	I	220	900
150	G. E.	I	2200	575

SLIP-RING

7½	Westgh.	CW	440	870
18	G. E.	10C5010	220	720
20	Allis-C.		440	860
20	G. E.	I-11	2200	900
20	Flyn-W.	MT326	2300	855
25	G. E.	I-10	220	670
35	G. E.	I	2200	600
50	G. E.	MT356	220	450
50	Al. Ch.	AR	2200	580
50	G. E.	I-8	2200	860
100	G. E.	I-M	220	450
250	Westgh.	CW	440	503

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Size	Description	Approx. Weight
.072" (#13 Awg)	Triple Cotton Cov., Round	306#
.072" (#13 Awg)	Asbestos Ins., Reels	134#
.081" (#12 Awg)	Single Glass Cov., Round	2,000#
.081" (#12 Awg)	Single Glass Cov., Round	685#
.129"	Asbestos Ins., Varnish, Round	495#
.049"x.437"	Double Cotton Cov., Rect.	647#
.051"x.114"	Double Glass Cov., Rect.	2,000#
.051"x.326"	Double Cotton Cov., Rect.	514#
.057"x.162"	Asbestos Ins., Rect.	851#
.057"x.305"	Double Glass Cov., Rect	825#
.064"x.312"	Double Cotton Cov., Rect.	600#
.064"x.325"	Asbestos Ins., Rect.	130#
.064"x.365"	Double Cotton Cov., Rect.	1,050#
.085"x.195"	Double Cotton Cov., Rect.	304#
.100"x.315"	Double Cotton Cov., Rect.	1,000#
.102#x.289"	Asbestos Cov., Rect.	692#
.102"x.325"	Double Glass Cov., Rect	10,000#
.106"x.256"	Double Glass Cov., Rect.	180#
.114"x.258"	Double Glass Cov., Rect.	421#
.144"x.229"	Double Cotton Cov., Rect.	1,000#
.162"x.162"	Asbestos Ins., Rect.	474#
.182"x.289"	Double Cotton Cov., Rect.	672#
.100"x.500"	Double Glass, Rect.	1,050#
.100"x.400"	Double Glass, Rect.	1,074#
.035"x.155"	Double Vitreous	1,681#
.070"x.250"	Double Vitreous	4,726#
.110"x.185"	Double Vitreous	3,160#
.21# Awg	Single Vitreous	2,800#
.17" Awg	Double Cotton Cov.	7,000#

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1—21 x 21 Ames Unaflow with D.C. generator 125-250 Volts.

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1—500 KW Wemco 60/3/440V/3600 RPM; 150-200# 10# B.P.

1—500 KW G.E. N.C. 3600 RPM 60/3/2300V 100-125#; 2# B.P.

1—500 KW 4 stage N.C. G.E. Turbine 210#, 150° S.H.

1—750 KW Moore-Allis 200#, 10# B.P. Generator: 3/60/440V.

1—500 KW Allis-Chalmers 3/60/2300V/3600 RPM surf. cond. Boiler complement.

1—500 KW Allis-Chalmers 3/60/2300/3600 RPM Cond. Turbogenerator. Complete Switchboard.

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1—1250 HP steam generation plant complete. Superheater, Economizer, Steel Encased 14 Retort Stoker, 100,000# Cont.

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1—500 HP Heine, 350#.

1—400 HP Comb. Eng. 350#.

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1—313 HP Edgemoor 250# 125° S.H. Stoker.

2—350 HP B&W Stirling 150# Stoker

1—500 HP Edgemoor 175# Stoker.

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3—200 KVA, 2300 to 115/230 volt Moloney, single phase, 60 cycle transformers. Bank of three offered at $2,000.00, rebuilt and guaranteed, immediate shipment, f.o.b. Fairmont, Minnesota.

200—General Electric new motors for blowers with specifications as follows: ¼ HP, 5K47E6404 frame, 3 phase, type K, 2875-3450 RPM, 50-60 cycle, 440 volt, GEJ 902, 55° rise continuous time rating, totally enclosed, flange mounting, ball bearing type. List price $32.00, offered at list, less 15% discount, no priority.

300—New Blowers with driving motors attached, B. F. Sturtevant. Housing is made of cast malleable iron. Inlet is 4½" diameter with 6" outside diameter flange; outlet 3½" diameter outside. Wheel is of the paddle blade type, constructed of steel and of welded construction, 6⅛" diameter. Wheel is attached to the motor shaft with a tapering pin and a set screw. Entire unit is painted with one coat of zinc chromate primer and two coats of haze gray lacquer. These units have a capacity of 170 CFM at 1½" static pressure. Offered at $65.00, each, less 15% discount, no priority.

200—New Ventilating Blowers with motors attached, B. F. Sturtevant, centrifugal type, the complete motor and fan are enclosed in a heavy sheet metal cabinet 23" x 23" x 26" suitable for floor, wall, or ceiling mounting. One entire side is used as the intake and the air is filtered thru a bronze screen filter. This filter is the Air Maze Corp. "Kleenflo" size 20" x 20 5/6" x 1 7/8". The exhaust is a 4½" x 5½" opening in a side at right angles to the intake. The exhaust side is drilled and tapped for one size C terminal tube. Motor is a G.E. 3 Phase, 60 cycle, 440 volt, ¼ HP, 1725 RPM with fan keyed to the motor shaft extension. The unit is designed to produce an air force of 400 CFM against a pressure of 1" of water. Total weight is 275 lbs., entire unit is painted gray. Offered at $145.00, each, less 15% discount, no priority.

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1—400 H.P. B & W Water Tube Boiler 160 Lbs.
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1—300 K.W. General Electric Turbine Generator Set 3/60/2300.
1—250 KVA. Allis-Chalmers, Moore Turbine Generator Set 3/60/2300.
1—100 K.W. Allis-Chalmers Generator Direct Connected to 14" x 16" Skinner Engine, 3/60/220
1—100 KVA Crocker-Wheeler Belt Generator 3/60/2300
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Built in 1926—Boiler built for 200 lbs.—Drums built for 231 lbs.
Drums 54" diameter 14' 2" wide
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2 nonreturn valves
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All trimmings. All suspension steel. All cleanout & explosion doors. Walk ways. Main steam header. Feed water piping.
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Both are modern and compact with all accessories, completely rebuilt; can be seen operating. Immediate delivery.

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1—Rice and Sargent Steam Engine, 18" bore x 36" stroke, direct connected to General Electric D.C. Generator, 600 Amps., 235 Volts, 150 R.P.M.
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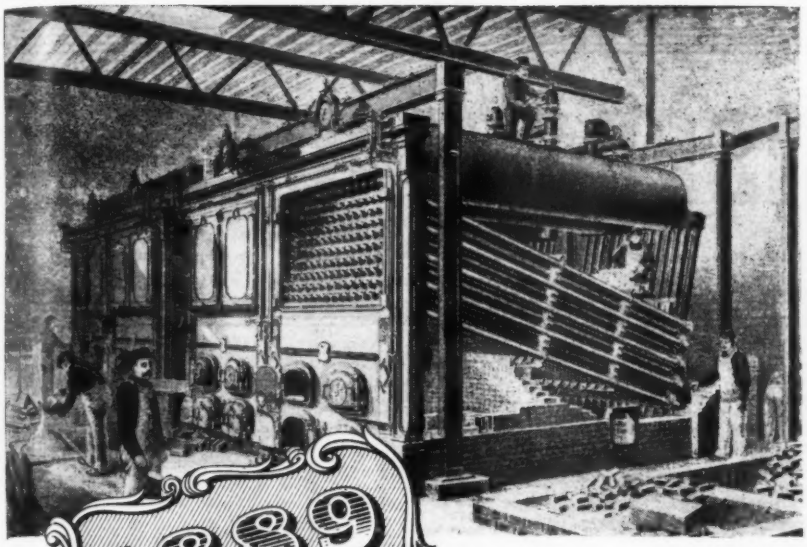


The body positions of these 1889 mechanics refute your grandfather's boast about "the killing pace of the old days" (Picture from Bettmann Archive.)

In 1889 they had to use brick ... but today you have PLIBRICO

• PICTURED above, in all its wood-cut glory, is the pinnacle of the boiler setter's art as practiced back in the bustling eighties. In significant contrast to the old way is the Plibrico sectionally-supported, air-cooled setting shown opposite. Here, in the fullest sense of the phrase, is the last word in modern boiler construction.

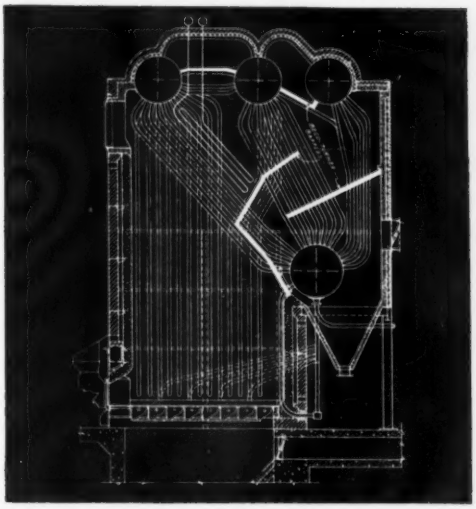
Strangely enough, some plants still cling to the old fire brick method in lining boiler furnaces. In 1889, it had to be fire brick . . . and the weakness of laid-up brick—the countless, vulnerable joints—had to be tolerated. But today the lining can be *jointless*. And thousands of installations prove that you have monolithic lining in its highest development when it is built of, and engineering by, Plibrico.

Whether it's an entirely new setting, a complete relining, or a small patch, Plibrico is the answer. Its ease of installation solves the present-day labor problem, and the facility with which it can be moulded into every form and contour eliminates special shapes in constructing door openings, burner rings, suspended arches, etc. For extreme conditions, Plibrico linings can be readily air-cooled and/or sectionally supported.

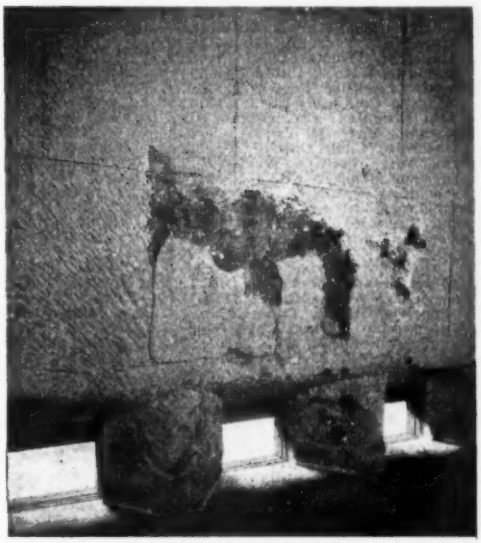
Your local Plibrico Sales and Service engineer will be glad to work with you on any refractory problem from the largest boiler setting down to the smallest repair job. Write for Plibrico catalog stating whether you operate water tube or fire tube boilers.

PLIBRICO JOINTLESS FIREBRICK CO.
1818 Kingsbury St., (Dept. H), Chicago 14, Illinois

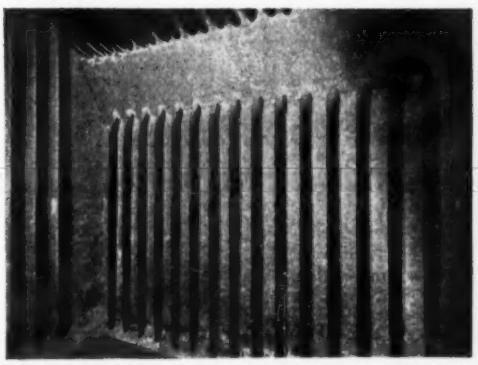
PLIBRICO *Jointless* FIREBRICK



Print representing two 638 hp. water tube boilers with spreader stokers recently installed. Both boilers provided with complete Plibrico air-cooled, sectionally-supported linings backing water walls, and Beco-Turner cross baffles.



Air-cooled Plibrico front wall of one of the 638 hp. boilers represented by print above. After full year of service, the Plibrico lining under the slag accumulation is still in perfect condition.



Rear wall of one of the boilers showing Plibrico backing behind water wall. Shelf above water wall is lower end of Beco-Turner baffle.

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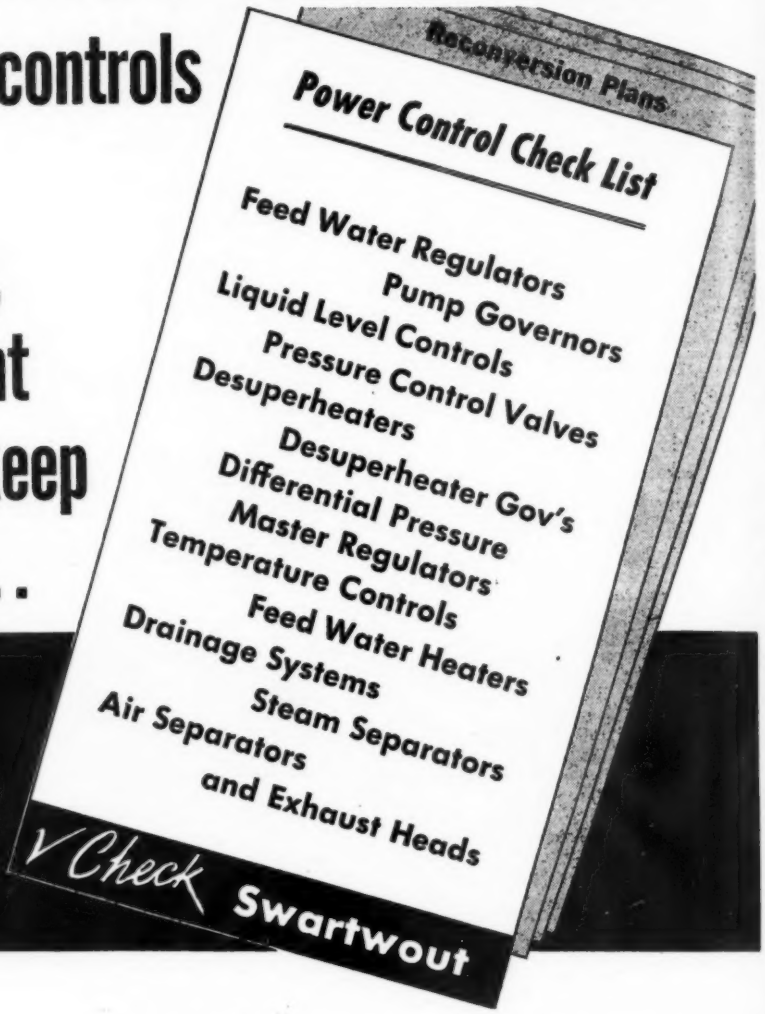

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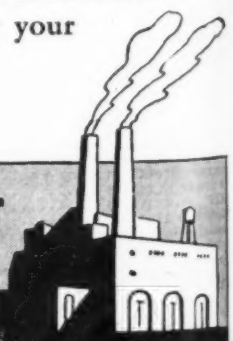

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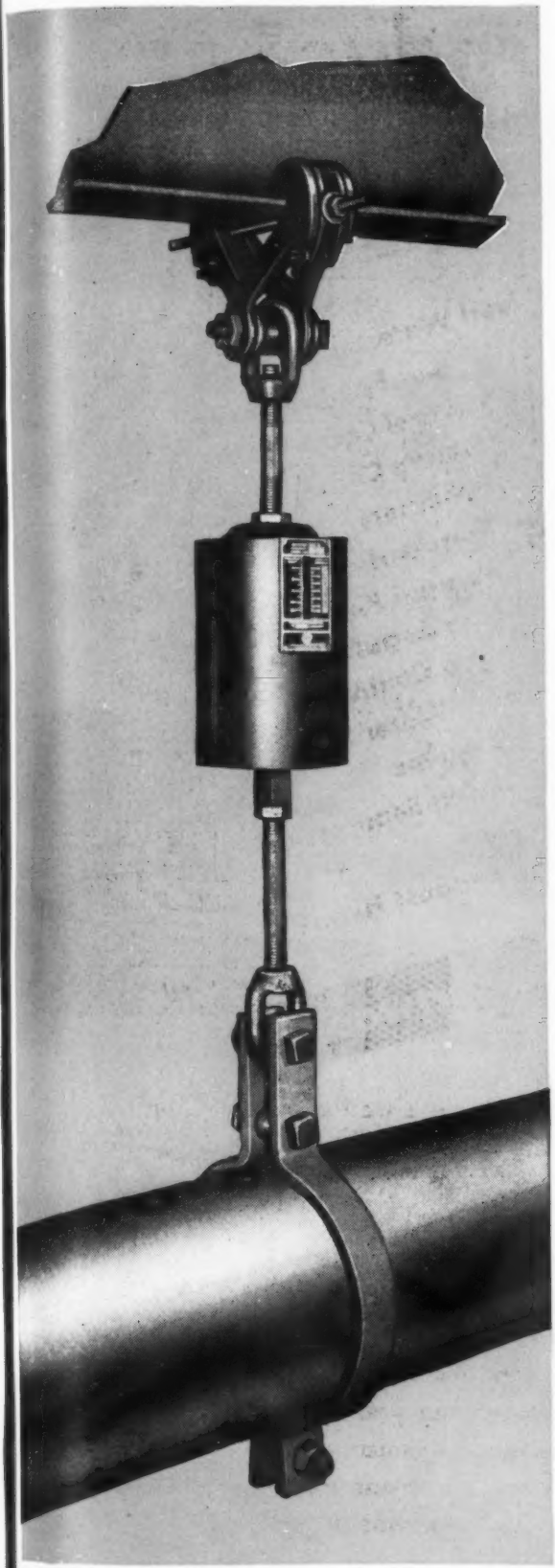

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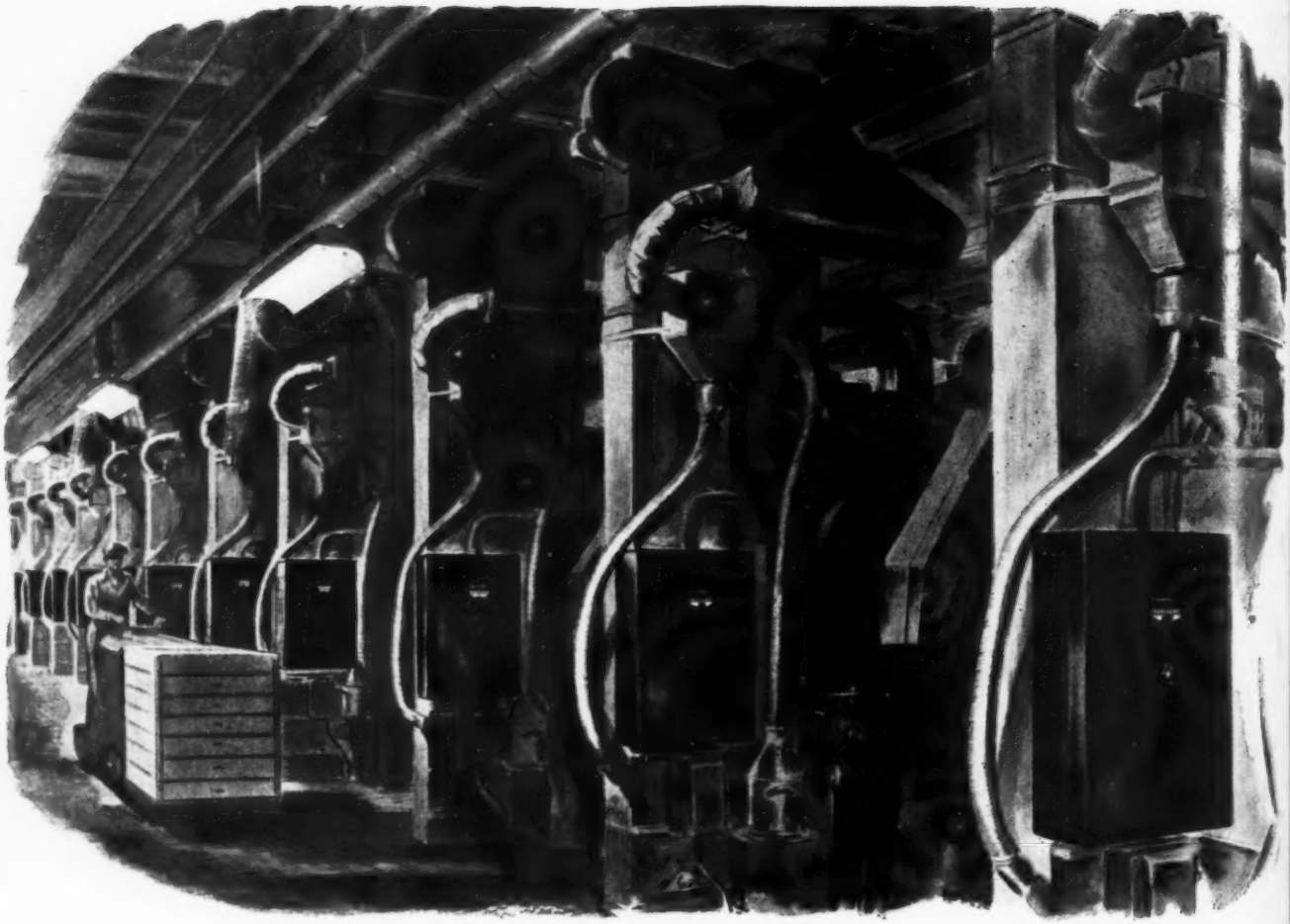

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